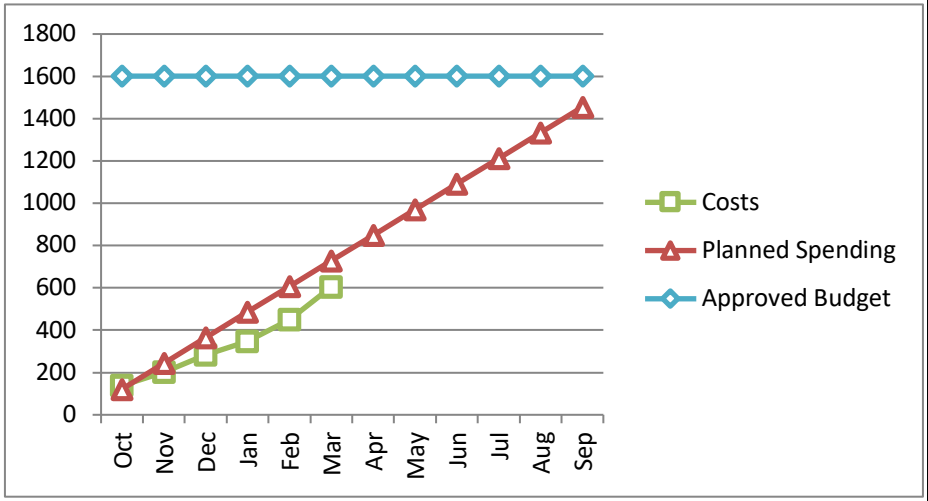
NUCLEAR CRITICALITY SAFTEY PROGRAM (NCSP)

FY2019 2ND QUARTER REPORTS

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: LANL AM1, AM2, AM4, AM5, AM6 Task Title: see last page M&O Contractor Name: LANL Point of Contact Name: Brian Bluhm / Bob Little Point of Contact Phone: 505-667-2440 / 505-665-3487	Reference: B&R DP0909010 Date of Report: May 7, 2019

BUDGET



1. **Carryover into FY 2019 = $0**
2. **Approved FY 2019 Budget = $1,601,000 (includes carryover)**
3. **Actual spending for 1st Quarter FY 2019 = $283,516**
4. **Actual spending for 2nd Quarter FY 2019 = $321,123**
5. **Actual spending for 3rd Quarter FY 2019 = $**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $146,000**

MAJOR ACCOMPLISHMENTS

- **MCNP R&D Work, continued to investigate & develop (AM1)**
  - region-dependent sensitivity-uncertainty data for NCS validation
  - fission matrix methods to diagnose & accelerate MC source convergence, also presented at NCSP Technical Program Review
  - diagnostic tests for undersampling & clustering
  - machine learning studies to understand the bias in criticality calculations and alternative ways to cluster similar benchmarks together, also presented at NCSP Technical Program Review
  - impact of correlated fission multiplicity models in criticality calculations
  - studies into validation for chlorine
  - impact of excluding benchmark outliers on the Whisper selection of similar benchmarks & on the Whisper baseline-USLs.
  - new & improved methods for static-alpha eigenvalue calculations
- **MCNP Support & Maintenance (AM1)**
  - **Milestone completed (ongoing, AM1): Support MCNP6 users.** MCNP Forum, email, direct interactions, etc.
  - **Milestone completed (AM1): Issue an MCNP V&V report, including ENDF/B-VIII.0,** report LA-UR-19-23348, ENDF/B-VIII.0 data & effects on results for MCNP validation suites, also presented at NCSP Technical Program Review.
  - **Milestone completed (AM1): Provide status of R&D and modernization efforts at the NCSP Technical Program Review,** M.E. Rising presentation at NCSP Technical Program Review

- Code modernization effort - Efforts are in progress to improve SQA, implement some MCNP-2020 features, & upgrade portions of MCNP6. Includes more formal planning, design proposals, improved code review, SQA tools, and more. (Most of funding is non-NCSP.)

- **Monte Carlo Education (AM1)**
  - **Milestone completed (AM1): Completed MCNP6 Criticality training course.**
    See separate summary of MCNP Q2 classes. More classes are scheduled for LANL, Y-12, Sandia.
  - Thesis advisor for UNM graduate student working in area of criticality calculations

- **Comparison of Sensitivity-Uncertainty-based USL Methods (AM4)**
  - Comparison of results from LANL & ORNL is in progress. Awaiting results from IRSN.

- **Comparison of ICSBEP Benchmark Results (AM5)**
  - Preliminary results were obtained from LANL, LLNL, ORNL, SNL, IRSN. Duhamel (IRSN) presented a summary of initial observations at TPR. Detailed comparison of results will occur later in 2019.

- **Technical Data for the Pitzer Formulation of Solution Compositions (AM6)**
  - Participated in teleconference with ORNL and LLNL, transmitted density data for uranium sulfate, literature search progressing for additional density data.

- **NJOY Development and Support (AM2)**
  - Continued to support NJOY users via emails sent to njoy@lanl.gov as well as issues submitted on GitHub.
  - We have been working on the Doppler broadening implementation in NJOY21, but this work is not finalized yet. We now expect to have it completed by the end of FY19.

- We have been working on ENDFtk and ACEtk, which both support the ACER implementation for fast neutrons.

- **Presentations at NCSP Technical Program Review**
  - F.B. Brown, “Automated Acceleration and Convergence Testing for Monte Carlo NCS Calculations”, LA-UR-19-20984 (2019) **[best paper award]**
  - J.L. Alwin, F.B. Brown, “Impact of Outliers and ENDF/B-VIII.0 on NCS Validation and USLs”, LA-UR-19-22159 (2019).
  - M.E. Rising, F.B. Brown, J.L. Alwin, “MCNP Status and Modernization”, LA-UR-19-22385 (2019).
  - Jeremy Conlin, ”NJOY21 Status and Plans”
  - Wim Haeck, “NJOY2016 Improvements for ENDF/B-VIII.0”
  - Jeremy Conlin, “Release of ENDF/B-VIII.0-based ACE Data Tables”
  - F.B. Brown, J.L. Alwin, M.E. Rising, brief presentations at Analytical Methods Working Group Meeting, on ENDF/B-VIII.0, statistical testing, impact of excluding outliers in NCS validation, benchmark comparisons with LANL/IRSN/LLNL/ORNL, USL comparisons with IRSN/ORNL

- **Reports & Publications:**
  - J.L. Alwin, F.B. Brown, M.E. Rising, "Verification of MCNP6.2 with ENDF/B-VIII.0 Nuclear Data for Nuclear Criticality Safety Applications”, LA-UR-19-23348 (2019).
  - J.L. Alwin, F.B. Brown, "Excluding Statistical Outliers in Nuclear Criticality Safety”, ANS Annual Meeting 2019, Minneapolis MN, LA-UR-19-20084 (2019).
  - B. Merryman, F.B. Brown. J.L. Alwin, C.Perfetti, “Investigating Region-wise Sensitivities for Nuclear Criticality Safety Validation”, ANS 2019 Summer meeting, LA-UR-19-20297 (2019).
  - F.B. Brown, C.J. Josey, S. Henderson, W.R. Martin, “Automated Acceleration and Convergence Testing for Monte Carlo Criticality Calculations”, ANS Mathematics & Computation, MCD 2019, Portland OR, LA-UR-19-23887 (2019)
  - F.B. Brown, C.J. Josey, S. Henderson, W.R. Martin, “Automated Acceleration and Convergence Testing for Monte Carlo Nuclear

	Criticality Safety Calculations", submitted to ICNC-2019, Paris FR, LA-UR-19-20482 (2019) o P. Grechanuk, M.E. Rising, T.S. Palmer, "Using Machine Learning Methods to Predict Bias in Nuclear Criticality Safety", Journal of Computational and Theoretical Transport, 47:4-6, 552-565 (2019), DOI: 10.1080/23324309.2019.1585877 o M.E. Rising, "Evaluating Sensitivity-Based Similarity Metrics Between Application and Benchmarks", submitted to ICNC-2019, Paris FR, LA-UR-19-20819 (2019). o P. Grechanuk, M.E. Rising, T.S. Palmer, "Identifying Sources of Bias from Nuclear Data in MCNP6 Calculations using Machine Learning Algorithms", ANS Mathematics & Computation, MCD 2019, Portland OR, LA-UR-19-20421 (2019). o D. Timmons, M.E. Rising, C. Perfetti, "The Use of MCNP 6.2 KCODE for High Fidelity, Near Critical Benchmarks", ANS Mathematics & Computation, MCD 2019, Portland OR, LA-UR-19-20522 (2019).

NCSP Quarterly Progress Report (FY-2019 Q2)

LANL AM Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Support MCNP6 users (AM1)		
	Support NJOY users (AM2)		
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2, AM4, AM5, and AM6)		
	Provide reports on summer intern work accomplished (AM1)		
Q2	Support MCNP6 users (AM1)		
	Support NJOY users (AM2)		
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2, AM4, AM5, and AM6)		
	Issue an MCNP V&V report, including ENDF/B-VIII.0 (AM1)		
	Provide MCNP6 Criticality training course (AM1)		
	Provide status of R&D and modernization efforts at the NCSP Technical Program Review (AM1)		

	Implement the Doppler broadening capabilities into the NJOY21 framework (AM2)		**Now scheduled for delivery in Q4.**
Q3	Support MCNP6 users (AM1)		
	Support NJOY users (AM2)		
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2, AM4, AM5, and AM6)		
	Release initial version of MCNP6 with automatic convergence testing & under-sampling diagnostics to several NCSP early-adopters for testing, issue report (AM1)		
Q4	Support MCNP6 users (AM1)		
	Support NJOY users (AM2)		
	Provide status reports on LANL participation in US and International analytical methods collaborations (AM1, AM2, AM4, AM5, and AM6)		
	Implement ACER fast neutron capabilities into the NJOY21 framework (AM2)		
	Issue report on the Sensitivity-Uncertainty Comparison Study (AM4)		
	Issue report on the ICSBEP Benchmark Comparison Study (AM5)		
	Document and release beta versions of ENDF/B-VIII.1 evaluations in ACE format on LANL website (AM1)		

NCSP Quarterly Progress Report (FY-2019 Q2)

Task Title:

AM1 MCNP Maintenance and Support, Uncertainty Analysis Development, and Modernization

AM2 NJOY Development and Maintenance, Uncertainty Analysis Development, and Modernization

AM4 Sensitivity/Uncertainty Comparison Study with a Focus on Upper Subcritical Limits

AM5 Proposed Benchmark Intercomparison Study

AM6 Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtasks: AM2, 3, 5, 6, 7

Task Titles:

AM2 Multiphysics Methods for the Simulation of Criticality Accidents
AM3 Slide Rule Application
AM5 Proposed Benchmark Intercomparison Study
AM6 Proposed 1-D Multipoint Analytical Benchmark Comparison
AM7 Technical Data for the Pitzer Formulation of Solution Compositions

M&O Contractor Name: Lawrence Livermore National Laboratory

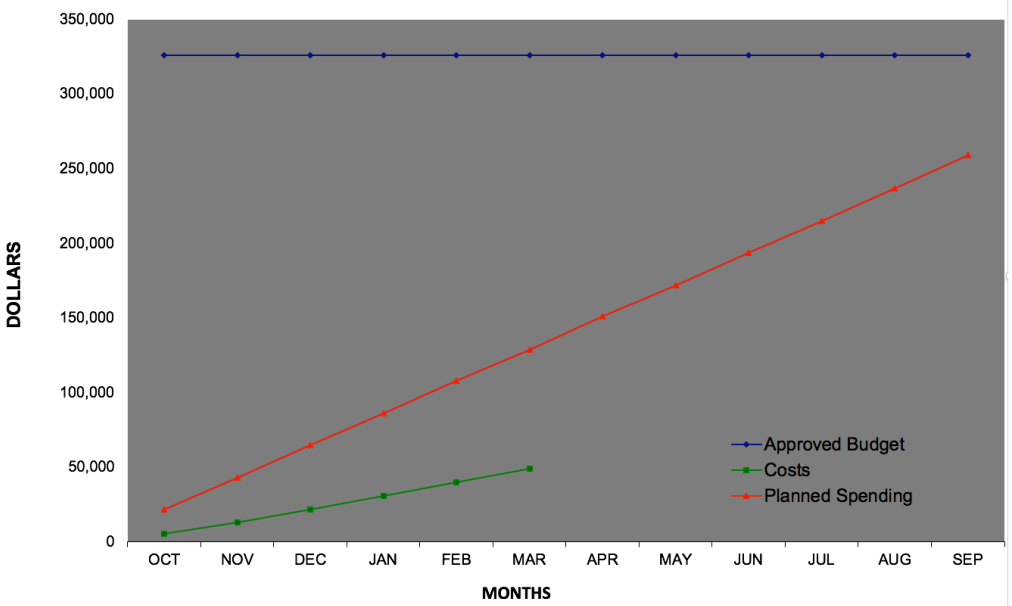
Point of Contact Name: David Heinrichs

Point of Contact Phone: (925) 424-5679

Reference: B&R DP0909010

Date of Report: May 10, 2019

BUDGET



1. **Carryover into FY 2019** = $45,203
2. **Approved FY 2019 Budget** = $326,203 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $22,055
4. **Actual spending for 2nd Quarter FY 2019**= $27,204 (not including $54,537 lien for AM6).
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $67,203 (21%)

MAJOR ACCOMPLISHMENTS

1. LLNL multiphysics methods development continues with the focus currently on implementation and testing of delayed neutrons in the sub-prompt super-critical regime (AM2).
2. A Slide Rule Application meeting was convened on March 27, 2019 following the NCSP TPR to determine the next phase of this collaborative project, which will focus on delayed fission gammas from plutonium systems and accident yields (AM3).
3. Provided additional high-precision COG benchmark results using ENDF/B-VII.1, ENDF/B-VIII.0 and JEFF-3.3 to Isabelle Duhamel (IRSN) for a total of 2,255 ICSBEP benchmark cases for inclusion in the Benchmark Intercomparison Study (AM5) as follows:

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PU: 570     U233: 193     MIX: 124
HEU: 817    IEU:  188     LEU: 363
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4. Isabelle Duhamel (IRSN) presented *Benchmark Intercomparison (IRSN-LANL-LLNL-ORNL Collaboration)* at the NCSP TPR on March 26, 2019 winning 'best paper.' (AM5).
5. Dr. Barry Ganapol, U. Arizona, commenced work on a multipoint (energy) extension to the Shmakov analytic benchmark (AM6).
6. LLNL (C. Percher), LANL (J. Alwin) and ORNL (C. Weber) discussed technical data needs for the Pitzer formulation on March 25, 2019 as part of the AM Working Group Meeting (AM7).

NCSP Quarterly Progress Report (FY-2019 Q2)

LLNL AM Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, AM5, AM6, AM7).		
Q2	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, AM5, AM6, AM7).		
Q3	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, AM5, AM6, AM7).		
Q4	Provide status on LLNL AM activities in NCSP Quarterly Progress Reports (AM2, AM3, AM5, AM6, AM7).		

Task Titles:

AM2 Multi-Physics Methods for Simulation of Criticality Excursions

AM3 Slide Rule Application

AM5 Proposed Benchmark Intercomparison Study

AM6 Proposed 1-D Multipoint Analytical Benchmark Comparison

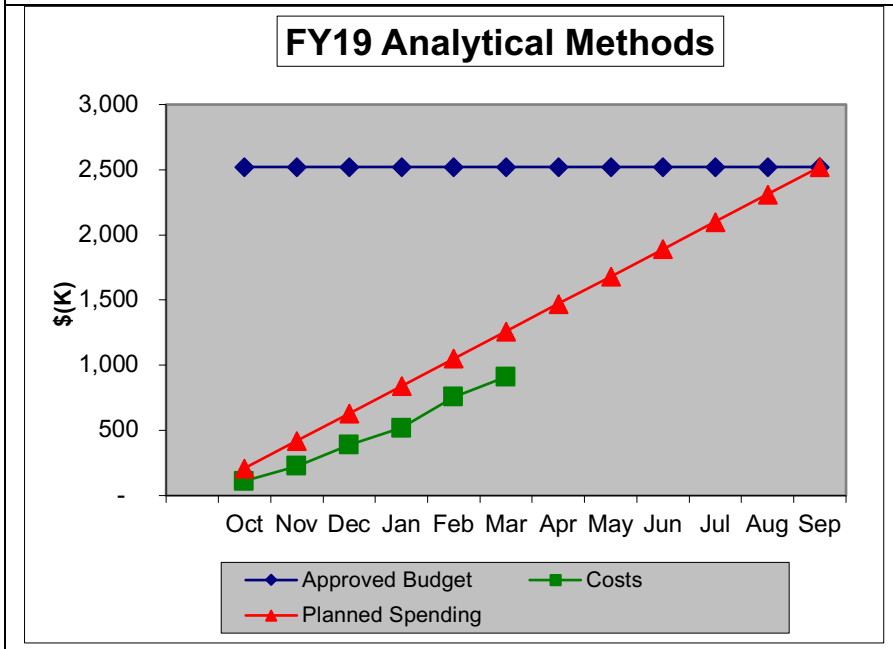
AM7 Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: ORNL – AM1, 2, 3, 6, 9, 10, 11, 13, 14, 15, 16
Task Titles: See last page
M&O Contractor Name: ORNL
Point of Contact Name: Doug Bowen
Point of Contact Phone: (865) 576-0315

Reference: DP090010/ORNL
Date of Report: April 29, 2019

BUDGET



1. **Carryover into FY 2019** = $301K
2. **Approved FY 2019 Budget** = $2521k (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $388K
4. **Actual spending for 2nd Quarter FY 2019** = $523
5. **Actual spending for 3rd Quarter FY 2019** = $0
6. **Actual spending for 4rd Quarter FY 2019** = $0
7. **Projected carryover into FY 2020 = ~$150K**

MAJOR ACCOMPLISHMENTS

AM1 – Distribution of available and newly packaged software

- Distributed 733 software packages and updated 1 software package.
- 121 SCALE, 365 MCNP®, and 1 COG packages distributed.
- RSICC quarterly report issued.

AM2 - SCALE/KENO/TSUNAMI Maintenance and Support/Cross-Section and Generation/Modernization

- Attended NCSP FY2018 annual program review at PANTEX in Amarillo, TX. Presentations focused on SCALE developments in FY2018 and Shift as an alternative Monte Carlo transport method to KENO in CSAS.
- Created the FY2018 SCALE Annual Report. The document is currently in the ORNL document review system with expected release early in Q3.
- Released SCALE 6.3 beta1 and beta2 internally to ORNL users. Beta3 was in progress during Q2 but will be reported (with beta4) in Q3.
  - Infrastructure/Maintenance
    - Updated continuous testing to post a detailed log associated with any failed tests to a central location to help developers debug. This kind of testing is run on Mac, Linux, and Windows machines and all tests must pass before code changes are allowed to be merged into the central repository. Many times a windows test would fail and debugging it with limited information was time consuming, as most developers do not develop on windows and must "borrow" one of the continuous testing machines to perform the debugging. The new system gives much more detail so that usually developers can determine and fix the issue without logging into a windows machine.
    - Updated many tests to use ENDF/B-VII.1 instead of ENDF/B-VII.0 in preparation for the removal of ENDF/B-VII.0 data in SCALE 6.3.0. SCALE 6.3.0 will include only VII.1 and VIII.0 data.
    - Added the ability to automatically generate beta release notes from internal QA, planning, and execution documents.
  - CSAS-Shift criticality safety analysis sequence
    - Improvements to the output for the new CSAS-Shift code to include more geometry descriptions and mixture information.
    - Improvements to hexagonal array geometry robustness and error reporting.

- Eliminated some trivial warnings generated by Shift that users do not need to see.
- Added ability analytically calculate volumes in CSAS-Shift models with KENO-V.a geometry.

▪ Fulcrum
- Official internal release of 3D visualization after improvements to hexagonal array geometry allowed viewing those geometry types. Many of the problems in the VALID test suite include hexagonal arrays and we were delaying finalizing the first implementation pass until these could be visualized without artifacts.
- Added support for autocomplete in the KMART uncertainty summarization sequence.

AM3 - AMPX Maintenance and Modernization

- An initial AMPX training course was taught in February, combining theory lectures with hands-on exercises. While the initial number of attendees was small (7, including 2 from South Korea), it gave us experience on teaching this particular course.
- We hosted a two-day GNDS mini meeting to discuss work on the API for the GNDS. Representatives from ORNL, LNL, BNL, and LANL attended. The current state of the API and the implementation status of GNDS in the processing codes was discussed.
- Work continued on the GNDS implementation in AMPX. Since the documentation for GNDS will now be built from specifications defined in JSON files, we decided to auto-generate the low-level GNDS access classes from those JSON files. The higher level AMPX functions than use these new low-level classes. This was finished to that we can process 1-D (including resolved and unresolved resonance data reconstruction) and many covariance data. Inconsistencies in the JSON files were fixed, committed and merged to the GNDS documentation project. In addition, we updated the documentation for the covariance data in the GNDS documentation project.
- The AMPX team attended the NCSP TPR in Amarillo and gave the AMPX status update report.
- While the ENDF/B-VIII.0 libraries were not changed, work continued in testing the libraries and to prepare the release with an upcoming SCALE beta release.

AM6 – SlideRule Application

- A meeting was held for discussing “fission yield” estimation of the proposed systems for the SlideRule update. Given that IRSN has the most interest in the fission yield calculations and lead of this task, ORNL only contributed in providing

suggestions (with no specific interest in the fission yield estimation) for the fission yield calculations and is waiting on IRSN to create a work plan and assign tasks.

AM9 - Sensitivity/Uncertainty Comparison Study with a Focus on Upper Subcritical Limits

- ORNL completed the memo report documenting the ORNL results. Representative ORNL results were presented and discussed with the other task participants at the Analytical Methods Working Group meeting held during the March NCSP TPR meeting. Once the IRSN results are made available, comparisons between all task participants will begin.

AM10 - Proposed Benchmark Intercomparison Study

- This task is a benchmark comparison with LLNL, LANL, and IRSN, to be coordinated by IRSN. IRSN has not provided or solicited any details regarding the details of this task, so no work was performed at ORNL in Q2 supporting AM10. Some work is anticipated in Q3 based on requests received at the Analytical Methods Working Group meeting at Pantex on March 25. This work will be focused on adding specific requested experiments to the VALID library and providing supporting details on other experiments already in VALID to facilitate comparisons of results by IRSN.

AM11 – Proposed 1-D Multipoint Analytical Benchmark Intercomparison

- This task is pending information from LLNL to proceed.

AM13 - Nuclear Data and Cross Section Testing Using ENDF/B-VIII.0

- During Q2 we performed initial verification and validation tests of the newly generated ENDF/B-VIII.0-based CE and MG libraries. Both CE and MG libraries were tested using simple verification tests.
- Next, further testing was performed by running 361 CSAS5 and 57 CSAS6 cases from VALID library of benchmarks using both ENDF/B-VIII.0 and ENDF/B-VII.1 libraries in both CE and MG modes. Initial results showed maximum differences up to around 4% for CE mode calculations. MG mode calculations showed only a fraction of a percent maximum differences. We are currently investigating why the differences are inconsistent. A detailed report is also being prepared.

AM14 - Development and Addition of Continuous-Energy Sensitivity Data Files to SCALE's VALID Library

- Sensitivity data files were completed for all 19 low-enriched uranium solutions in Q2. A limited number of calculations are still on-going in an effort to improve results for some problematic cases. VALID paperwork will be generated in Q3 or Q4, and the review process will be started at that time.

	○ Approximately 115 of the 140 low-enriched uranium pin array cases have been run in CE TSUNAMI. The remaining cases will be run in Q3 and direct perturbation calculations will be performed for an appropriate subset of these experiments to confirm that the sensitivity data are accurate. VALID paperwork will also need to be generated and reviewed. Depending on qualification and staff availability, the VALID review could take into Q4 or potentially even into FY20. ○ As mentioned in the Q1 progress report, the student has modeled a significant number of deuterium-moderated experiments to investigate KENO performance for these systems. In Q2 he has defended his master's project based on these calculations and submitted an abstract to ICNC. The abstract was accepted, so writing and submitting a full paper will be included in Q3 work. ○ Work Travis Greene has performed on deuterium validation for his master's degree is being leveraged to justify qualification for the VALID procedure. Travis's qualification will greatly assist in the generation and review of VALID documentation as no additional qualified co-author would be needed for each experiment. **AM15 - The Effects of Temperature on the Propagation of Nuclear Data Uncertainty in Nuclear Criticality Safety Calculation** ○ This is a university task at MIT and is overseen by Vlad Sobes. By the end of Q2, a contract was completed with MIT and a student has been identified for this PhD-level project. Work begins in Q3. **AM16 - Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers** ○ Jen Alwin was able to locate a LANL report that contained density measurements for UO2(SO4)2 in acid between 7 and 25°C. The principal purpose of the report was to establish spectroscopic methods for measuring concentration, but did contain some density data, which is exactly the type of information that we are seeking. All three PI's (Jen Alwin, Catherine Percher, and Charles Weber) attend the NCSP Technical Program Review in Amarillo the week of 25 March, 2019. We presented briefly at the Analytical Methods Working Group meeting on Monday afternoon, and several others expressed interest in the work. Isabelle Duhamel (IRSN) noted that she might have access to some fissile solution data, notably UO2F2, and she would begin looking for it after the TPR.

NCSP Quarterly Progress Report (FY-2019 Q2)

ORNL AM Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Continue distribution of available and newly packaged software to the NCS community requesters (at no direct cost to them) and provide distribution totals quarterly. (AM1)		
	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest. (AM2, AM3)		
	Provide status on ORNL AM activities in NCSP Quarterly Progress Reports. (AM1, AM2, AM3, AM6, AM9, AM10, AM11, AM13, AM14, AM15, AM16)		**See above**
Q2	Continue distribution of available and newly packaged software to the NCS community requesters (at no direct cost to them) and provide distribution totals quarterly. (AM1)		
	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest. (AM2, AM3)		
	Provide status on ORNL AM activities in NCSP Quarterly Progress Reports. (AM1, AM2, AM3, AM6, AM9, AM10, AM11, AM13, AM14, AM15, AM16)		
	Issue an annual SCALE maintenance report to the NCSP Manager. (AM2)		**This report will be completed by the end of Q3.**
Q3	Continue distribution of available and newly packaged software to the NCS community requesters (at no direct cost to them) and provide distribution totals quarterly. (AM1)		
	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide brief trip		

	summary report to NCSP Manager on items of NCSP interest. (AM2, AM3)		
	Provide status on ORNL AM activities in NCSP Quarterly Progress Reports. (AM1, AM2, AM3, AM6, AM9, AM10, AM11, AM13, AM14, AM15, AM16)		
Q4	Continue distribution of available and newly packaged software to the NCS community requesters (at no direct cost to them) and provide distribution totals quarterly. (AM1)		
	Provide status reports on ORNL participation in US and International Analytical Methods collaborations and provide brief trip summary report to NCSP Manager on items of NCSP interest. (AM2, AM3)		
	Provide status on ORNL AM activities in NCSP Quarterly Progress Reports. (AM1, AM2, AM3, AM6, AM9, AM10, AM11, AM13, AM14, AM15, AM16)		
	Publish annual newsletter to users to communicate software updates, user notices, generic technical advice, and training course announcements. (AM2)		
	Document AMPX modernization and technical support for SCALE CE, multigroup, and covariance libraries and report status annually to the NCSP Manager. (AM3)		

NCSP Quarterly Progress Report (FY-2019 Q2)

Task Titles:

AM1 Radiation Safety Information Computational Center (RSICC)

AM2 SCALE/KENO/TSUNAMI Maintenance and Support/Cross-Section and Generation/Modernization

AM3 AMPX Maintenance and Modernization

AM6 Slide Rule Application

AM9 Sensitivity/Uncertainty Comparison Study with a Focus on Upper Subcritical Limits

AM10 Proposed Benchmark Intercomparison Study

AM11 Proposed 1-D Multipoint Analytical Benchmark Intercomparison

AM13 Nuclear Data and Cross Section Testing Using ENDF/B-VIII.0

AM14 Development and Addition of Continuous-Energy Sensitivity Data Files to SCALE's VALID Library

AM15 The Effects of Temperature on the Propagation of Nuclear Data Uncertainty in Nuclear Criticality Safety Calculations

AM16 Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtasks: IPD1, 2, 4

Task Titles:

IPD1 Conduct ICSBEP for Benchmarks listed in Appendix C of the 5-Year Plan and publish annual revision to the Handbook

IPD2 Maintain the NCSP Website and Systems

IPD4 Benchmark Evaluation of Hot Box, LLNL Historical Critical Configurations at High Temperature

M&O Contractor Name: Lawrence Livermore National Laboratory

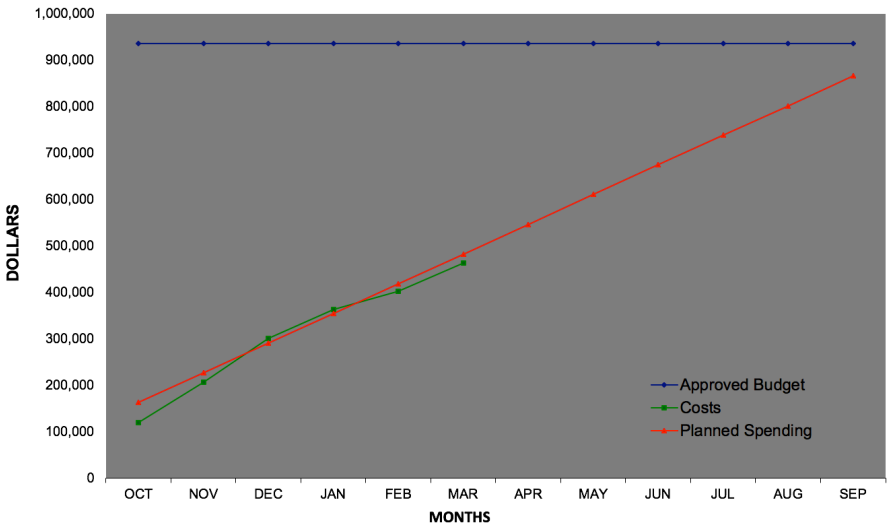
Point of Contact Name: David Heinrichs

Point of Contact Phone: (925) 424-5679

Reference: B&R DP0909010

Date of Report: May 10, 2019

BUDGET



1. **Carryover into FY 2019** = $102,907
2. **Approved FY 2019 Budget** = $935,907 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $301,469
4. **Actual spending for 2nd Quarter FY 2019**= $161,932
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $69,907 (8%)

MAJOR ACCOMPLISHMENTS

1. ICSBEP 2018 (IPD1). The three NCSP evaluations submitted to the ICSBEP meeting on October 22, 2018 are now (CED-4b) completed and approved for publication, namely:
   - **IER-407**, FUND-LLNL-ALPHAN-U235-MULT-001, ISSA Subcritical Multiplicity Benchmark (LLNL)
   - **IER-422**, FUND-NCERC-PU-HE3-MULT-003, Copper and Polyethylene-Reflected Plutonium Metal Sphere Subcritical Measurements (SCRaP) (LANL)
   - **IER-451**, LEU-COMP-THERM-099, Titanium and Aluminum Sleeve Experiments in Fully-Reflected Water-Moderated U(4.31)O_2 Fuel Rod Lattices with 2.8 cm Pitch (SNL)
2. ICSBEP 2019 (IPD1). NCSP evaluations in progress for the October 21-25, 2019 ICSBEP meeting include:
   - **IER-184**, TEX baseline experiments with PANN plates moderated by polyethylene (LLNL)
   - **IER-192**, Class foils moderated and reflected by Lucite (LANL)
   - **IER-209**, LEU-COMP-THERM-101, 7uPCX, 0.855 cm pitch, variable water height (SNL)
   - **IER-299**, KRUSTY cold/warm critical experiments (LANL)
   - **HMF086**, Godiva-IV major revision (corrections) (LANL)
3. Website and Systems (IPD2).
   - Provided NCSP website updates as requested by NCSP Management and deployed new webpages for the NCSP TPR.
   - Deployed the public version of NDA website at https://nda-dev.llnl.gov.
   - Maintained and updated NTS-SLAN/NCERC classified network.
   - Configured new TV/Display (70") for entry into DAF.
   - Upgraded all NCERC desktop systems to Windows 10 (version 1809).

   Provided equipment inspections, certifications and data transfers (IPD2) supporting:
   - IER-462: NCSP T&E Hands-On Training (LANL)
   - IER-464: NCSP T&E Hands-On Training (LLNL)
   - IER-465: Non-NCSP NDSE Experiments FY16 and FY17 (LANL)
   - IER-492: Non-NCSP Nuclear Smuggling Detector Development May 2018 (LANL)
   - IER-494: Non-NCSP RTO TI Project Sept 2018 (LANL)
   - IER-503: Non-NCSP Crit Class for JTOT (LANL)
4. Hot Box (IPD4).

   Formal evaluation of "Hot Box" commenced this quarter including a description of the experiment (Section 1) and a start on the benchmark model (Section 3).

NCSP Quarterly Progress Report (FY-2019 Q2)

LLNL IP&D Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
			

QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IPD1)		
	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (IPD1)		
	Maintain, operate and modernize he NCSP website, databases, and provide user assistance as required. (IPD2)		
	Provide a status report for the evaluation of the LLNL "Hot Box" for inclusion in the ICSBEP Handbook. (IPD4)		
Q2	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IPD1)		
	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (IPD1)		**All 3 NCSP evaluations completed this quarter and accepted for publication.**
	Maintain, operate and modernize he NCSP website, databases, and provide user assistance as required. (IPD2)		
	Provide a status report for the evaluation of the LLNL "Hot Box" for inclusion in the ICSBEP Handbook. (IPD4)		**Evaluation commenced this quarter.**
Q3	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IPD1)		
	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (IPD1)		
	Maintain, operate and modernize he NCSP website, databases, and provide user assistance as required. (IPD2)		
	Provide a status report for the evaluation of the LLNL "Hot Box" for inclusion in the ICSBEP Handbook. (IPD4)		

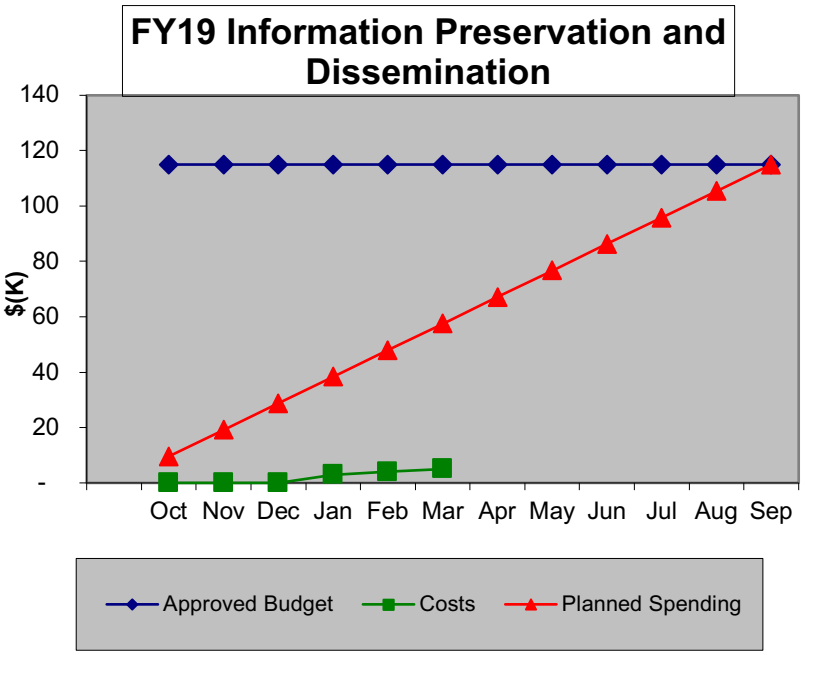
Q4	Manage all aspects of the DOE NCSP participation in the ICSBEP as required to ensure the finalizing and publishing ICSBEP evaluations per IE schedule. (IPD1)		
	Provide status reports on LLNL participation in US and International IPD collaborations (including ICSBEP) and provide brief summary report to NCSP Manager on items of NCSP interest. (IPD1)		
	Maintain, operate and modernize he NCSP website, databases, and provide user assistance as required. (IPD2)		
	Provide a status report for the evaluation of the LLNL “Hot Box” for inclusion in the ICSBEP Handbook. (IPD4)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: ORNL – IPD5, 6
Task Titles:
IPD5-Oak Ridge Health Physics Research Reactor CAAS Benchmark Evaluation
IPD6- Preservation and Dissemination of Unpublished Critical Experiments by Mihalczo
M&O Contractor Name: ORNL
Point of Contact Name: Doug Bowen
Point of Contact Phone: (865) 576-0315

Reference: DP090010/ORNL
Date of Report: April 29, 2019

BUDGET



1. **Carryover into FY 2019** = $0K
2. **Approved FY 2019 Budget** = $115K (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $0K
4. **Actual spending for 2nd Quarter FY 2019** = $5K
5. **Actual spending for 3rd Quarter FY 2019** = $0
6. **Actual spending for 4rd Quarter FY 2019** = $0
7. **Projected carryover into FY 2020 = $0**

MAJOR ACCOMPLISHMENTS

IPD5 – Oak Ridge Health Physics Research Reactor CAAS Benchmark Evaluation

- Cathy Romano and I reviewed the existing documentation for HPRR in lab records.
- HPRR experiment logs and archive data was reviewed for experiment configuration and data.
- Log book and archive data is missing key details for modeling experiments, most notable design details for the building and shielding configuration. Additional documentation is being collected to fill these gaps. In particular the building design/as built drawings are being sought for review. Additionally, detailed output for finalized experiment results are not in HPRR log archives and internal reports. We are looking for the final experiment results that were often published by other divisions/organizations. These should contain the additional details needed.
- To accomplish this a walkdown of the facility and potential sources of other records are scheduled for completion by the end of this quarter. This will allow us to make the go/no-go determination of the detail of the existing data needed for modeling and simulation input.

IPD6 – Preservation and Dissemination of Unpublished Critical Experiments by Mihalczo

- Mihalczo has provided a listing of experiments with sufficient information and data to potentially be applicable for a benchmark evaluation.
- Cathy Romano is currently working on looking through the available data for each of these experiments to cull the list based on information availability
- Mihalczo is providing information on the experiments on the list free of charge in an effort to preserve some of the information. Perhaps this additional information, beyond the scope of this task, will be sufficient for ANS summaries or reports in the future.

Spending will significantly increase in Q3 and Q4, as this project is now assigned to ORNL staff for completion. These two tasks were originally slated to be performed by Thomas Miller who left the group in late 2018.

NCSP Quarterly Progress Report (FY-2019 Q2)

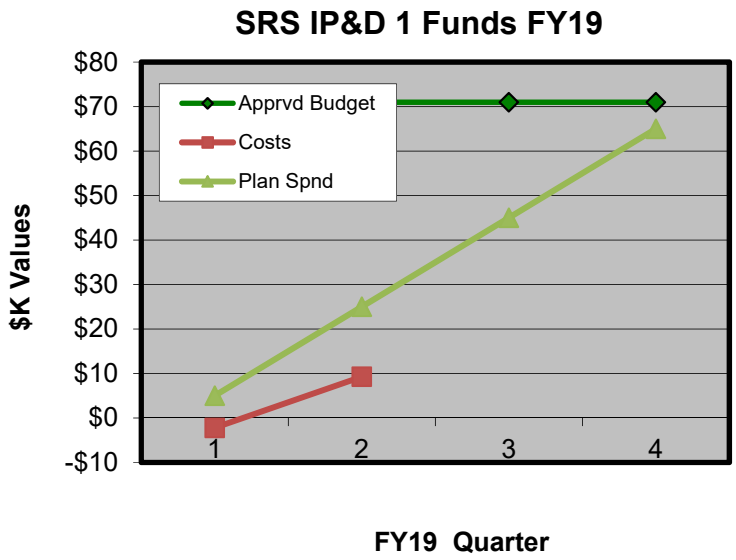
ORNL IPD Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	Complete documentation of data needed for an ICSBEP benchmark based on the ORNL HPRR (IPD5)		We are engaging HPRR facility management to obtain the data archives and logbooks. More progress is expected in Q3.
Q3	Perform initial evaluation of HPRR data and determine if this task should continue (IPD5)		
Q4	Perform some initial benchmark simulations to evaluate the quality of the data collect in IPD5 and the ability to simulate the measured data (IPD5)		
	Report on progress made with the review of 25 critical experiments and their potential applicability and quality for generating ICSBEP evaluations in an FY20 NCSP proposal (IPD6)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: SRS IPD1 **Task Title:** ARH-600 Reissue **M&O Contractor Name(s):** SRNS **Point of Contact Name:** David Erickson **Point of Contact Phone:** 803-557-9445	Reference: B&R DP 0909010 Date of Report: Apr 23, 2019
BUDGET	**MAJOR ACCOMPLISHMENTS**
 1. **Carryover into FY 2019** = $1.9K 2. **Approved FY 2019 Budget** = $ 70.9K (includes carryover) 3. **Actual spending for 1st Quarter FY 2019** = $-2.2K 4. **Actual spending for 2nd Quarter FY 2019** = $11.5K 5. **Actual spending for 3rd Quarter FY 2019** = $ 6. **Actual spending for 4rd Quarter FY 2019** = $ 7. **Projected carryover into FY 2020** = $	QA Documents are complete. The code has been revised to incorporate identified changes. An updated user manual is being drafted. Work is progressing on external release and export control approvals.

NCSP Quarterly Progress Report (FY-2019 Q2)

SRS IP&D Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

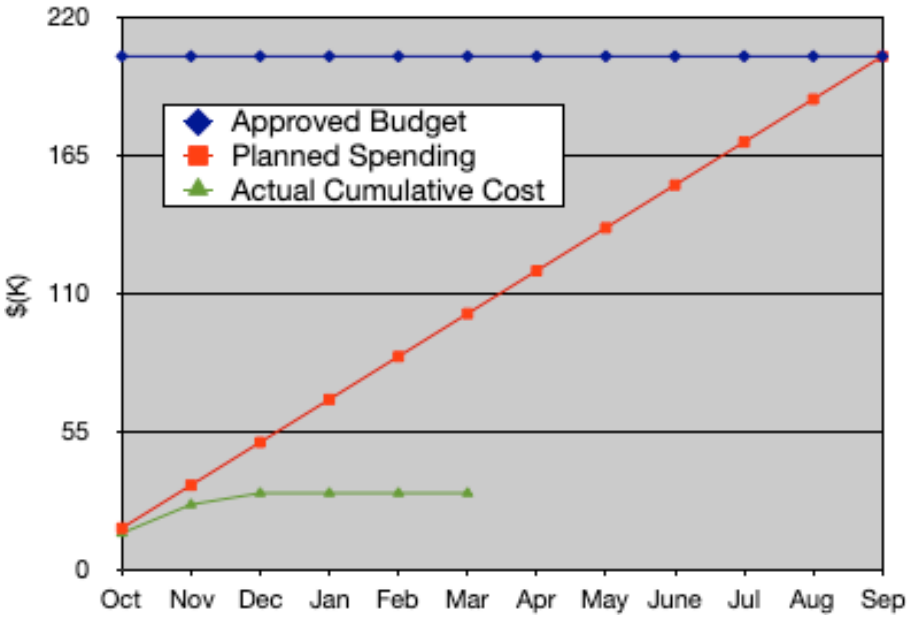
Complete	On Schedule	Behind Schedule	Missed Milestone
			

QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Provide status reports on SRS progress. (IPD1)		
Q2	Provide status reports on SRS progress. (IPD1) Develop QA documents for current version to meet current SRS/DOE requirements. (IPD1)		
Q3	Provide status reports on SRS progress. (IPD1)		
Q4	Provide status reports on SRS progress. (IPD1)		
	Issue Preliminary (updated) CritView version for internal testing. (IPD1)		
	Issue Preliminary User Guide to support internal testing. (IPD1)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: Nuclear Data ND1 Task Title: National Nuclear Data Center (NNDC) Support to the NCSP M&O Contractor Name: BNL Point of Contact Name: David Brown Point of Contact Phone: 631-344-2814	Reference: DP0909010 Date of Report: May 14, 2019

BUDGET



1. **Carryover into FY 2019** = $24,444
2. **Approved FY 2019 Budget** = $224,444 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $31,019
4. **Actual spending for 2nd Quarter FY 2019** = $0
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $24,000

MAJOR ACCOMPLISHMENTS

NCSP Quarterly Progress Report (FY-2019 Q2)

BNL ND Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

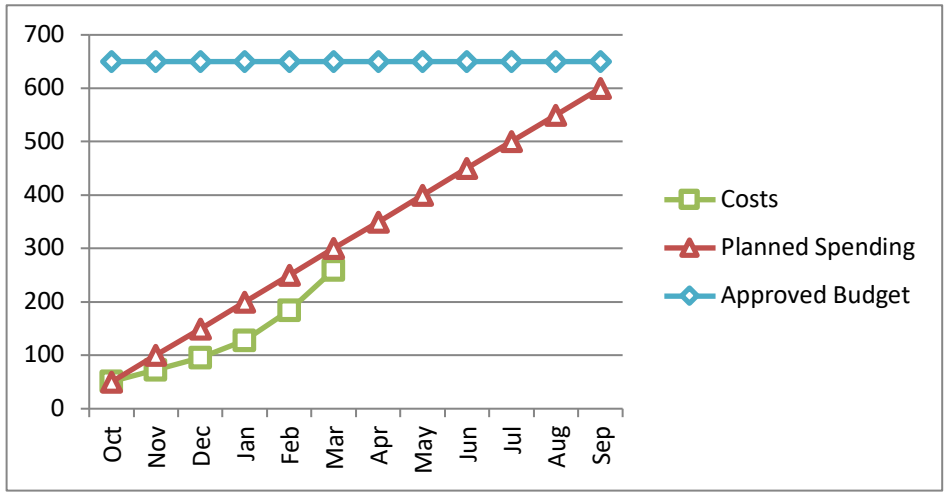
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		Porting ADVANCE (and all of its dependencies) to Python3 is taking longer than anticipated. Also, actively interviewing for potential NCSP post-doc.
Q2	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		**ADVANCE is ported to Python3 and Buildbot 2.1. Still interviewing for potential post-doc.**
Q3	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		
	If mandated by CSEWG, release new ENDF library. (ND1)		
Q4	Maintain and upgrade ADVANCE code system by performing data verification of new NCSP evaluations and performing quality assurance on the data as required and provide status reports on all nuclear data support activities to the NCSP Manager. (ND1)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: LANL ND1
Task Title: Nuclear Data Evaluation and Testing
M&O Contractor Name: LANL
Point of Contact Name: Brian Bluhm / Bob Little
Point of Contact Phone: 505-667-2440 / 505-665-3487

Reference: DP0909010
Date of Report: May 7, 2019

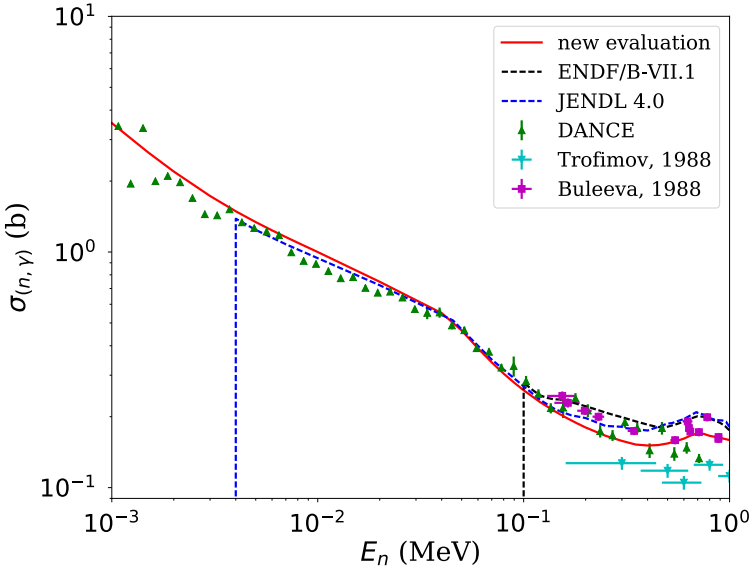
BUDGET



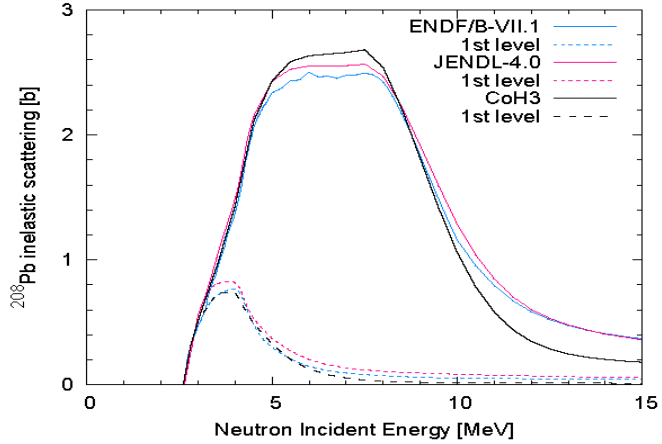
1. **Carryover into FY 2019 = $0**
2. **Approved FY 2019 Budget = $650,000 (includes carryover)**
3. **Actual spending for 1st Quarter FY 2019 = $96,044**
4. **Actual spending for 2nd Quarter FY 2019 = $163,795**
5. **Actual spending for 3rd Quarter FY 2019 = $**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $50,000**

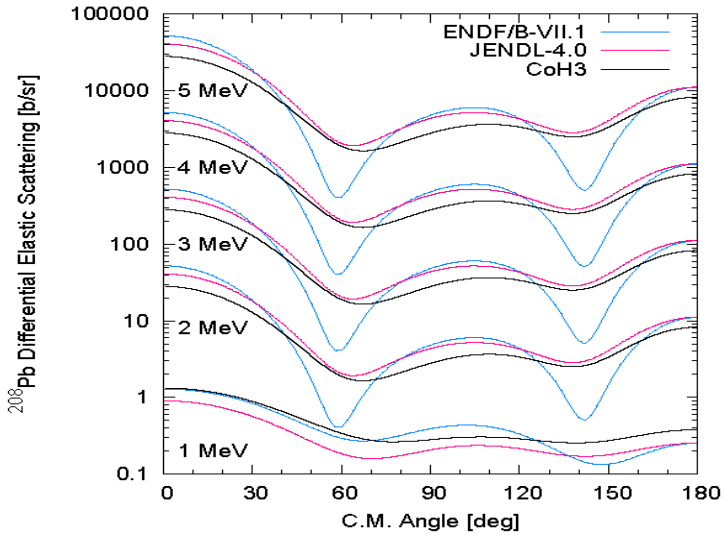
MAJOR ACCOMPLISHMENTS

- ^{236}U evaluation: we have produced a test file with the full evaluation, that contains the capture data measured at LANSCE and the new fission cross section evaluation based on the Tovesson data. The file passes all tests and could be delivered to NNDC. However, the resonance parameters that were extracted from LANSCE measurements for the s-wave are in the Reich-Moore representation, while currently in ENDF for ^{236}U the resonance parameters are represented in multilevel Bright-Wigner format, which means that if we replace only the s-wave, the resonance parameters will not have a consistent representation, and the format does not allow for such a case. At the NDAG meeting in Pantex, following the NCSP annual review, we have established a collaboration with Marco Pigni (ORNL), who is analyzing the feasibility of a re-evaluation of the resonance parameters using LANSCE data. As an example, we present the comparison between the evaluated capture cross section and experimental data, as well as JENDL and ENDF/B-VII.1 in Fig. 1. The evaluation was based on CoH calculations, adjusted to ^{238}U capture data.



- We are considering benchmarks that include ^{234,236}U in order to test the performance of the new evaluation files
- Pb-208 evaluation: We have completed work above the resonance range and are preparing to test the results using both quasi-differential and criticality benchmarks. Examples of current results for inelastic scattering cross section and elastic scattering angular distributions (relative to ENDF/B-VII.1 and JENDL-4.0 are shown below.





- We continue our involvement in two IAEA nuclear data projects, one on benchmarking R-matrix codes for charged-particle reactions, and the other on R-matrix analyses of systems such as n+14N (15N), n+9Be (10Be), and n+23Na (24Na).
- We have submitted an abstract, which was accepted for oral presentation, to ICNC2019, where we will discuss the current ^{234,236}U and progress on ^{239}Pu evaluations.
- We have submitted an abstract to NEDPC 2019 based on work on the evaluation of prompt fission gammas in ^{235,238}U and ^{239}Pu, partially supported by NCSP.
- Submitted for publication in Nuclear Data Sheets: “Evaluation of the prompt fission gamma properties for neutron induced fission of ^{235,238}U and ^{239}Pu” by I. Stetcu et al, which details the evaluation included in the ENDF/B-VIII.0 release with partial support from NCSP.

- **Presentations at NCSP Technical Program Review**
  - P. Talou, M.E. Rising, “Using Machine Learning Algorithms to Uncover Hidden Patterns in Nuclear Data Sensitivity Calculations”
  - Ionel Stetcu, “Los Alamos Updates to Nuclear Data Evaluations”

NCSP Quarterly Progress Report (FY-2019 Q2)

LANL ND Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
	Conduct CSEWG Data Evaluation Committee session. (ND1)		
	Report data testing results with ENDF/B-VIII.0 and additional beta release cross sections. (ND1)		
Q2	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q3	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
Q4	Provide status reports on LANL participation in US and International Nuclear Data collaborations. (ND1)		
	Report on development of machine learning tools, in particular decision trees, for criticality-safety applications and sensitivity to nuclear data. (ND1)		
	Deliver nuclear data evaluations as indicated in Appendix B of this document. (ND1)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: ND1, 2, 3, 5, 6

Task Titles: See last page for full task titles

ND1 Delayed fission gammas
ND2 Generation and testing of thermal scattering laws
ND3 FLASSH (modern code)
ND5 Advanced Doppler Broadening
ND6 Cadmium radiative capture gammas

M&O Contractor Name: Lawrence Livermore National Laboratory

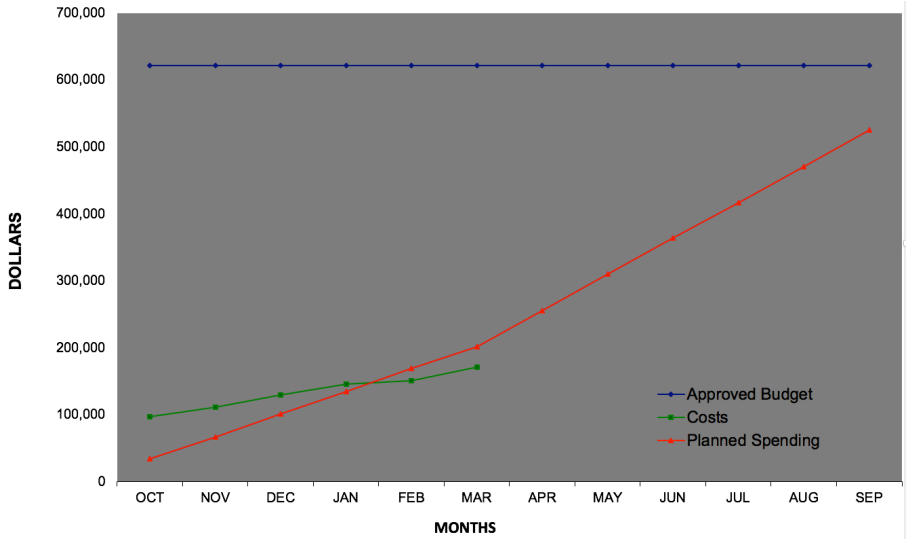
Point of Contact Name: David Heinrichs

Point of Contact Phone: (925) 424-5679

Reference: B&R DP0909010

Date of Report: May 10, 2019

BUDGET



1. **Carryover into FY 2019** = $181,360
2. **Approved FY 2019 Budget** = $621,360 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $130,142*
4. **Actual spending for 2nd Quarter FY 2019**= $ 41,306
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $96,360 (15%)

*Q1 QPR projections revised based on actual invoices received from NCSU.

MAJOR ACCOMPLISHMENTS

1. The feasibility of implementing LLNL's Fission Reaction Yield Algorithm (FREYA) into COG is being assessed. (ND1)

2. (a) NCSU completed the TSL generation and QA processes for the first "beta-version" of hydrogen in **light water**. The TSL library was delivered to Naval Reactors for additional analysis and testing. (b) The TSL generation and QA process was completed for hydrogen in **heavy oil** and this library is ready for transfer to NNDC and release to users. (c) Evaluation of the MD modeling approach for **hydrofluoric acid** (HF) continued. Several interatomic potentials were identified that contain components for the both inter- and intramolecular energy terms (i.e., Lennard-Jones, point charges, perturbed Morse oscillators, etc.). This is consistent with the structure of HF as it represents small molecules whose behavior is largely dominated by hydrogen bonding dynamics. This fact results in the temporal formation of long chains (sometimes rings) of HF molecules. This behavior is expected to be reflected in some capacity in the density of states (DOS) analysis of HF. (ND2)

3. NCSU continued work on the *FLASSH* code. The liquid physics module has been tested on the hydrogen and carbon components of heavy oil and compared to relevant LEIP modified NJOY16 output. The addition of a scaled alpha/beta grid into the new module resulted in excellent agreement between both codes (in certain areas, the LP module is clearly better, providing higher levels of resolution). Incorporation of this module into the *FLASSH* main code is underway and will involve modifying the input file structure, adding an effective "interface" for feeding relevant data to the liquid physics module, and modifying the output file structure. In addition, the LLNL FUDGE code has been used successfully to convert a LEIP-generated File 7 to GNDS format. This document has not, however, been strenuously checked for accuracy and completeness. Moving forward, the code looks as if it will meet our formatting needs from/between our current file outputs to/and the newly developed GNDS format. Interaction with the *FLASSH* code is currently being examined to determine the best path forward. (ND3)

4. NCSU continued the development of algorithms using a generalized non-cubic treatment in the calculation of the TSL and its utilization in Doppler analysis. A more accurate formulation of the self (i.e., incoherent) scattering law has been derived to relieve the

	assumption of cubic lattice symmetry and generalize the microstructure used in TSL calculations. In addition, the atom site approximation has been alleviated by representing each atom individually in the calculation. The individual terms are now defined with the generalized microstructure where the inputs are the polarization vectors e_s and the associated frequencies ω_s. These generalized equations are currently being implemented within the Full Law Analysis Scattering System Hub (*FLASSH*), with the phonon dispersion relations as inputs. For verification, an average phonon density of states along with a non-cubic, generalized equivalent, was calculated for beryllium metal. Current effort is focused on extending the generalized analysis through the TSL evaluation process and benchmarking results against both cubic and non-cubic parameters including the non-cubic Debye-Waller displacement matrix. (ND5) 5. The UC-Davis McClellan reactor ports are nearly direct line of sight to the reactor. LLNL measurements indicate substantial gamma-ray background from the reactor that seriously complicates a Cd neutron capture gamma-ray measurement. To make this experiment feasible an indirect thermal neutron beamline must be used. On a recent trip to Kansas State University, a thermal neutron beamline with an off-axis reflected beam came to our attention. The beam port has a flux on the order of 1000 n s^{-1} cm^{-2}. NCSU also has a beam port at their reactor without a direct line of sight to the core. They may have suitable beam options with low gamma background and with filtered thermal neutron flux levels in the range of 10^5 to 10^6 n s^{-1} cm^{-2}. In either case, an in-situ measurement of the gamma-ray background at the port location needs to be performed to assess the quality of the location for a Cd neutron capture experiment. If such a location is suitable, or could be made suitable with appropriate shielding for the detector, then we would have a reliable location in the United States to perform thermal capture gamma ray spectroscopy. (ND6)

NCSP Quarterly Progress Report (FY-2019 Q2)

LLNL ND Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
			

QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager (ND1 {subtask 1 and 2}, ND2, ND3, ND5, ND6).		
Q2	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager (ND1 {subtask 1 and 2}, ND2, ND3, ND5, ND6).		
Q3	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager (ND1 {subtask 1 and 2}, ND2, ND3, ND5, ND6).		
Q4	Provide status on LLNL/NCSU nuclear data activities to NCSP Manager (ND1 {subtask 1 and 2}, ND2, ND3, ND5, ND6).		
	Deliver thermal neutron scattering data evaluations as indicated in Appendix B of the 5-Year Plan. (ND2)		**Evaluations completed one or more years in advance of schedule.**

Task Titles:

ND1 Subtask 1 – Delayed Fission Gamma Multiplicity and Spectra – Data testing
ND1 Subtask 2 – Delayed Fission Gamma Multiplicity and Spectra – Document the technical basis of the method and data testing results

ND2 Generation and Benchmarking of Thermal Neutron Scattering Cross Sections in Support of Advanced Nuclear Reactor Concepts

ND3 Development and Implementation of an Advanced and Rigorous Computational Platform for Thermal Neutron Scattering Analysis

ND5 Development and Implementation of a Modern Doppler Broadening Approach Including Atomic Binding Effects

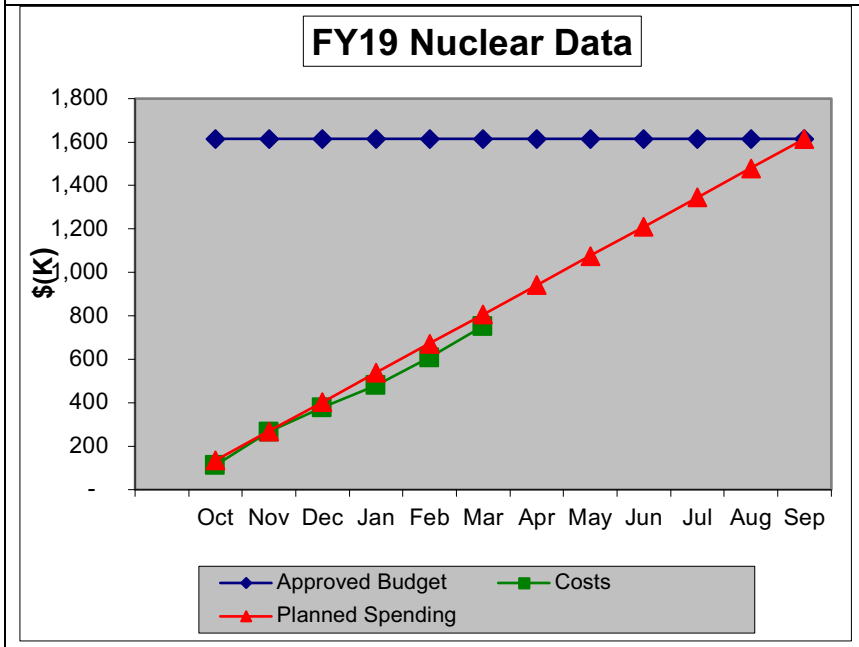
ND6 Evaluate Neutron Radiative Capture Gamma Production in Cadmium

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: ORNL – ND1, 3, 6, 7, 10
Task Title: see last page
M&O Contractor Name: ORNL
Point of Contact Name: Doug Bowen
Point of Contact Phone: (865) 576-0315

Reference: DP090010/ORNL
Date of Report: April 29, 2019

BUDGET



1. **Carryover into FY 2019** = $124K
2. **Approved FY 2019 Budget** = $1,615K (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $379K
4. **Actual spending for 2nd Quarter FY 2019** = $374
5. **Actual spending for 3rd Quarter FY 2019** = $0
6. **Actual spending for 4rd Quarter FY 2019Y** = $0
7. **Projected carryover into FY 2020 = $0**

MAJOR ACCOMPLISHMENTS

ND1 – Evaluations and Measurements

- **Status report on all nuclear data support activities.**
  - Gd-156,158,160 (On Schedule)
    Resolved resonance region evaluation of differential experimental nearing completion.
  - Pb-204,206,207,208 (On Schedule)
    Initial fitting of differential experimental data has begun for the isotopes of lead. Particular attention is given to the identification of the quantum angular momentum group structure for the resonances of Pb-207 which were previously incorrect due to outdated ENDF format restrictions.
  - Work on Cr data for re-evaluation.
  - Support of post-doc for Ce data analysis.
  - Support of post-doc for V data analysis, provided data and SAMMY files.
  - Supporting cerium evaluations (on schedule). Preliminary set of resonance parameters and covariance matrix were generated. This work is planned to be reported in the ICNC2019 paper
  - Work on the presentation for NCSP TPR meeting in Amarillo, TX. Major achievements during FY18 in evaluation work were presented.
  - Keep on working on 233U (on schedule)
  - Minor work on ^{56}Fe by including direct capture component coupled ot other adjustment to the resonance parameters gave promising results in resolving the benchmark issue (on schedule)
  - Support to the Tantalum evaluation in collaboration with RPI. A preliminary set of resonance parameters showed reasonable agreement with the transmission data and adopted thermal cross sections (on schedule)
  - Letter report for silicon evaluations reviewed and published

- **Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B of the 5-year plan.**
  - Travel to JRC-Geel to continue Ce-142 transmission experiments and initiate capture experiments (green)
  - Travel to JRC-Geel to start data reduction for Ce-142 transmission experiments. The list mode data are sorted into TOF spectra. (green)
  - Start data reduction for thick V sample for analysis. (green).
  - Path forward: continue working on La capture data. Start working on Ce-142 experiments.
  - Enriched Zr experiments are delayed, due to problems obtaining samples for lease. (behind schedule). However, this issue seems to be resolved. Path forward: After finalizing the Ce-142 experiments, enriched Zr neutron capture experiments will be started.

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: ORNL – ND1, 3, 6, 7, 10 **Task Title:** see last page **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP090010/ORNL **Date of Report:** April 29, 2019
BUDGET	**MAJOR ACCOMPLISHMENTS**
	Y12 ND1 – GELINA depleted Uranium target cost estimate and construction • Support to Y12 personnel for Uranium target production **ND3 – Isotopic Sample Lease to Support ND1 ND Measurements** o Ce-142 sample was leased in early fall from ORNL for neutron induced cross section experiments at JRC and is on site for experiments. (green) o Preparation for lease of Zr samples, preparing for activation experiments and calculation. **ND6 - Sammy Modernization** o The SAMMY Team attended the NCSP TPR in Amarillo and gave the SAMMY FY2018 status update report. o SAMMY was moved to a new code repository (code-int.ornl.gov). This allows us to use more of the infrastructure in place for SCALE. Especially it is now easier to set up a continuous integration pipeline. A continuous integration pipeline allows to automatically compile the code and run all unit tests and report back on several platforms. We started the process by setting up the pipeline on LINUX using one configuration – other pipelines are currently being worked on. o The new code repository also has a different issues page to track progress as well as bug fixes. Initial issues were opened and one bug, reported by internal users, was fixed. o A SAMMY bug reported by a LANL SAMMY user has been resolved, and a patch has been provided to the user. o Steps are being taken toward open source licensing of SAMMY. **ND7 - Nuclear Data Evaluation and Testing for Nuclear Criticality Safety Applications** o Isotopes of interest (recently evaluated in Appendices B1 & B2) were used as DICE criteria to determine a list of experiments from the ICSBEP handbook, with further input from ORNL advisors used for the elimination of several based on in-depth knowledge of experiment accuracy and methods. Experiments were chosen for their sensitivity to cross section reaction changes from ENDF/B-VII.1 to VIII.0. o Results for 8 benchmarks have been modeled and run in CE MCNP and KENO, 3 being ZEUS benchmarks identified and modeled for potential future entry into the VALID suite. o Prepared and presented for the Annual NCSP Technical Program Review, which entailed a summary of purpose and efforts, as well as initial results of study. o Materials involved in evaluations to this point mainly contain copper, with results showing general improvement with updated cross sections.

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: ORNL – ND1, 3, 6, 7, 10 **Task Title:** see last page **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP090010/ORNL **Date of Report:** April 29, 2019
BUDGET	**MAJOR ACCOMPLISHMENTS**
	○ The upcoming summer will be spent on site at ORNL under further guidance of criticality safety professionals. ○ Further examination of appropriate benchmarks containing thermal compounds is needed, due to the use of DICE for sensitivity data being less effective for nonisotopic media. **ND10 - Monte Carlo Evaluation of Differential and Integral Data** ○ A considerable amount of time was spent in attempts to setup the SHIFT Monte Carlo neutron transport code on the SUMMIT supercomputer. However, in consultation with the SHIFT code developers it was determined that the SHIFT code cannot yet be used on the SUMMIT supercomputer in the way it has been envisioned. Consequently, in order to demonstrate the benefits of the proposed method, this project will be scaled down to the ORNL's Reactor and Nuclear Systems Division computer cluster. Familiarity with this computer cluster will be conducive to demonstrating this project, albeit on a smaller scale. After demonstrating the project on a smaller scale, we have mapped out the steps needed to implement using the SHIFT code on the SUMMIT supercomputer in the following FY, in collaboration with the SHIFT code developers and the Oak Ridge Leadership Computing Facility (olcf.ornl.gov) personnel. ○ A postdoctoral researcher who was originally assigned to this project has been moved to work on other projects. Consequently, the remaining team members will take over the tasks formerly assigned to the postdoctoral associate. ○ The two developments listed above have caused delays, but we are committed to demonstrating advantages of this project during this FY.

NCSP Quarterly Progress Report (FY-2019 Q2)

ORNL ND Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND3, ND6, ND7, ND10).		
	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1).		
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).		Behind schedule with Ce-142 measurements due to sample shipping delays and a bad Ce-142 Al can weld that had to be redone.
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND3, ND6, ND7, ND10).		
	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1).		
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).		
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND3, ND6, ND7, ND10).		
	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1).		
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).		

Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports (ND1, ND3, ND6, ND7, ND10).		
	Provide status reports on ORNL participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND1).		
	Complete cross-section measurement and evaluation deliverables per the nuclear data schedule in Appendix B (ND1).		
	Document SAMMY modernization progress and report status annually to the NCSP Manager (ND6).		

Task Titles:

ND1 Nuclear Data Measurement and Evaluation

ND3 Isotopic Sample Leases to Support ND1 ND Measurements

ND6 SAMMY Nuclear Data Evaluation Code Modernization

ND7 Nuclear Data Evaluation and Testing for Nuclear Criticality Safety Applications

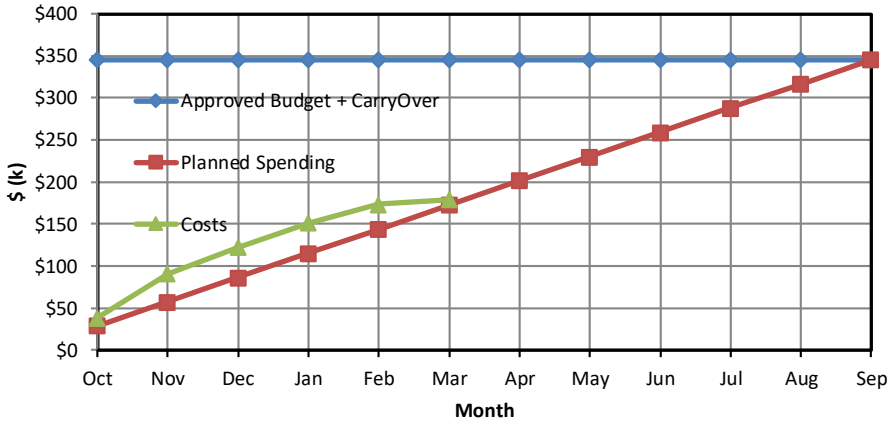
ND10 Monte Carlo Evaluation of Differential and Integral Data

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: ND1
Task Title: Resonance Region Nuclear Data Measurement Capability at RPI
M&O Contractor Name: RPI
Point of Contact Name: Yaron Danon
Point of Contact Phone: 518-276-4008

Reference: BNR Code 0909010
Date of Report: May 6, 2019

BUDGET



1. **Carryover into FY 2019** = $ 5,733
2. **Approved FY 2019 Budget** = $345,733 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $122,637
4. **Actual spending for 2nd Quarter FY 2019** = $56,636
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** -$12,813

MAJOR ACCOMPLISHMENTS

- Presented a method for validation of URR parameters TPR 2019
- Wrote ANS summary for evaluation and validation of Ta-181 cross sections
- Wrote journal publication on experiment for validation or URR parameters of Ta-181

NCSP Quarterly Progress Report (FY-2019 Q2)

RPI ND1 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
			

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)		**Nothing to report for Q1**
	Complete analysis of measurement from FY18. (ND1)		
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)		**Nothing to report for Q1**
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)		
	Complete transmission measurement per the nuclear data schedule in Appendix B. (ND1)		**Material for transmission was not selected; scattering measurements for Zr-nat are planned.**
	Complete capture measurement per the nuclear data schedule in Appendix B. (ND1)		**NDAG asked us to schedule Cu measurements instead.**
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND1)		

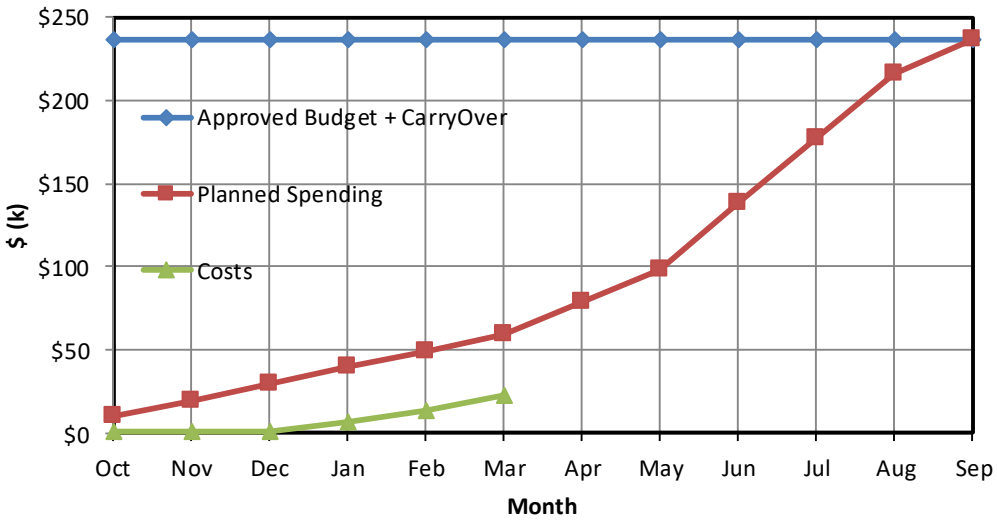
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest. (ND1)		
	Complete data analysis for transmission and capture measurements and provide the data to ORNL as needed to support the evaluation effort per the nuclear data schedule in Appendix B (ND1)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: ND2
Task Title: Thermal Neutron Scattering Measurement for Improvement of Criticality Calculations and Propagation of Scattering Kernel Uncertainties
M&O Contractor Name: RPI
Point of Contact Name: Yaron Danon
Point of Contact Phone: 518-276-4008

Reference: BNR Code 0909010
Date of Report: May 6, 2019

BUDGET



1. **Carryover into FY 2019** = $35,974
2. **Approved FY 2019 Budget** = $235,974 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $1,190
4. **Actual spending for 2nd Quarter FY 2019** = $21,684
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $100,000

MAJOR ACCOMPLISHMENTS

- Performed an experiment with 77K moderator as a feasibility study of preliminary cold moderator design.
- Analyzed experimental data.
- Validated simulation capabilities using the experimental data.

Funding note: our PhD student working on this project won a full 3-year DOE-NEUP scholarship, which will create a carryover.

NCSP Quarterly Progress Report (FY-2019 Q2)

RPI ND2 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

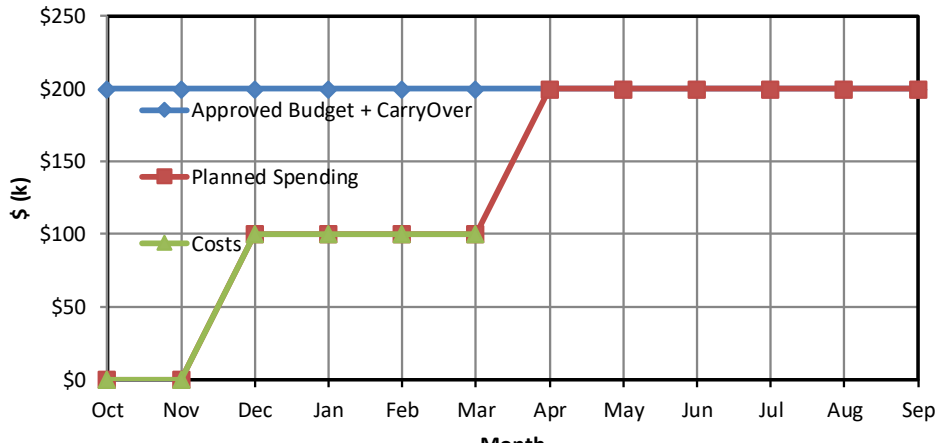
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND2)		**Nothing to report in Q1**
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND2)		**Nothing to report in Q1**
	Complete cold moderator preliminary design phase (ND2)		
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND2)		
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND2)		
	Provide status reports on RPI participation in US and International Nuclear Data collaborations, and for foreign travel, provide a brief trip summary report to NCSP Manager on items of NCSP interest (ND2)		
	Complete cold moderator design (ND2)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: ND3
Task Title: RPI/ORNL: LINAC 2020 Nuclear Data Capabilities Maintenance Plan
M&O Contractor Name: RPI
Point of Contact Name: Yaron Danon
Point of Contact Phone: 518-276-4008

Reference: BNR Code 0909010
Date of Report: May 7, 2019

BUDGET



1. **Carryover into FY 2019** = $0
2. **Approved FY 2019 Budget** = $200K (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $100K
4. **Actual spending for 2nd Quarter FY 2019** = $0
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $0

MAJOR ACCOMPLISHMENTS

- Modulator 1 Factory acceptance test (FAT) successfully accomplished.
- Information from FAT of modulator-1 used to complete preparations for FAT of modulators 2-5.
- Shipping of modulator 1 was initiated.

NCSP Quarterly Progress Report (FY-2019 Q2)

RPI ND3 Milestones:

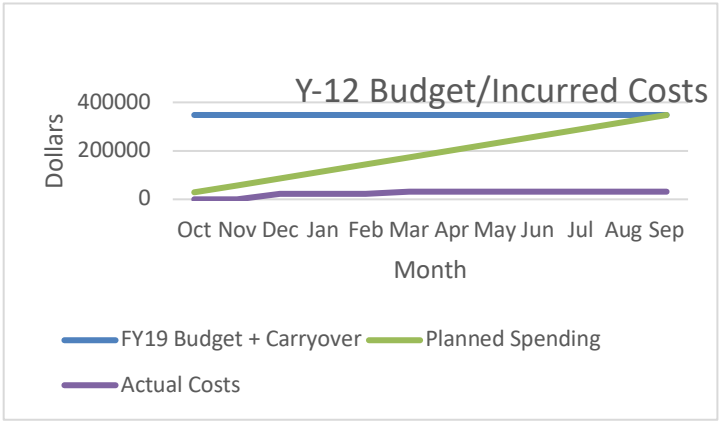
STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)		
	Factory acceptance tests of RF Modulators 2 and 3 (ND3)		
Q2	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)		
	Delivery of RF Modulator 1 and Klystron 1 (ND3)		**Cascade of delay I Modulator 1 factory test**
	Factory acceptance tests of RF Modulators 4 and 5 (ND3)		**Cascade of delay I Modulator 1 factory test**
Q3	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)		
	Factory Acceptance test for Tapered Phase Velocity and Speed of Light #1 Accelerator Sections (ND3)		
Q4	Provide status reports on all nuclear data support activities in NCSP Quarterly Progress Reports. (ND3)		
	Delivery and of TPV and SOL1 Accelerator Sections (ND3)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtasks: ND1 **Task Title:** Fabrication of New Uranium Target for IRMM/GELINA for Cross-section Measurements **M&O Contractor Name:** Y12 **Point of Contact Name:** Kevin Reynolds **Point of Contact Phone:** (865) 241-9067	**Reference: B&R DP0909010** **Date of Report: May 23, 2019**
BUDGET	**MAJOR ACCOMPLISHMENTS**



1. **Carryover into FY 2019** = $97,968
2. **Approved FY 2019 Budget** = $347,968 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $22,487
4. **Actual spending for 2nd Quarter FY 2019** = $9,167.78
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $

- Q1: Complete set of fabrication drawings complete in Q1. Coordinated with US and Belgium.
- Q2: For the 2nd quarter we were able to get the purchase order documents drafted (Statement of Work, sole source form, etc.) and had the drawings updated again to reflect some minor clarifications between the proposed supplier and the GELINA technical staff. We also had the supplier prepare an estimate for shipping the target directly to Belgium and incorporated this requirement into the SOW during one of several iterations required to make everyone happy. We have now gotten all of the documentation through DC Review.

NCSP Quarterly Progress Report (FY-2019 Q2)

Y12 ND Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

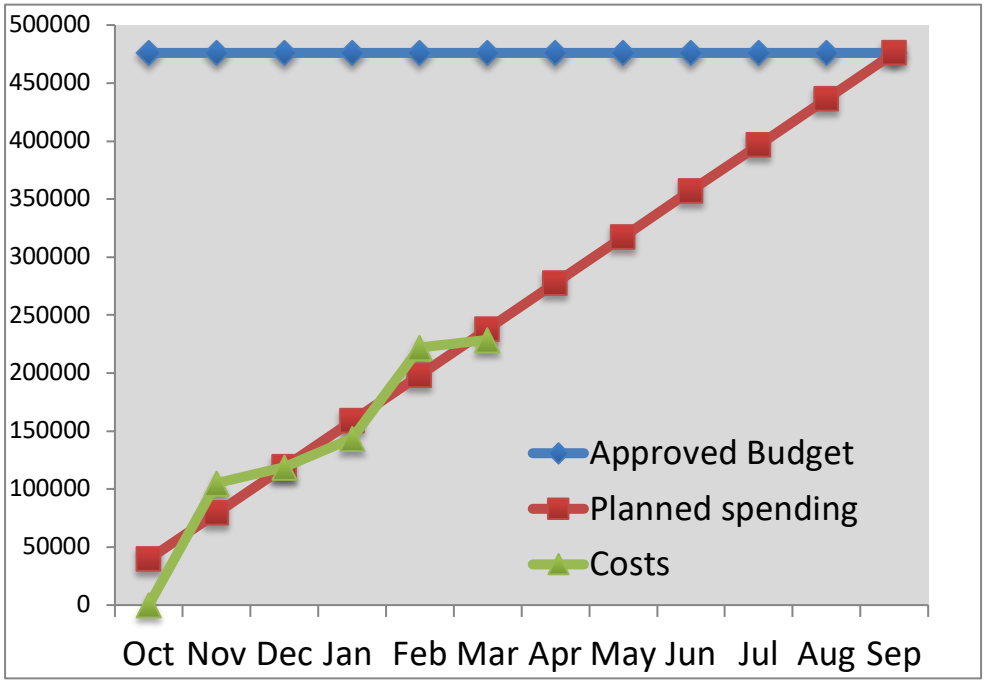
QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)		Fabrication of part to commence in Q2
Q2	Provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)		Fabrication of part is behind schedule. Will not complete this FY – tracking for end of Calendar 2019 at the moment.
Q3	Provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)		
Q4	Provide a status report of the fabrication of a depleted uranium/molybdenum target per IRMM/GELINA specifications to the NCSP Manager. (ND1)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element: LANL TE3
Task Title: Conduct Hands-On Criticality Safety Training Course at NCERC
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian Bluhm
Point of Contact Phone: (505) 667-2440

Reference: DP0909010
Date of Report: May 10, 2019

BUDGET



1. **Carryover into FY 2019 = $100K**
2. **Approved FY 2019 Budget = $ 476K**
3. **Actual spending for 1st Quarter FY 2019 = $118.9K**
4. **Actual spending for 2nd Quarter FY 2019 = $109.8K**
5. **Actual spending for 3rd Quarter FY 2019 = $**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $**

MAJOR ACCOMPLISHMENTS

• Supported the NCERC “hands on” training for the two week Criticality safety practitioner training that occurred in Q2.

NCSP Quarterly Progress Report (FY-2019 Q2)

LANL TE3 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
			

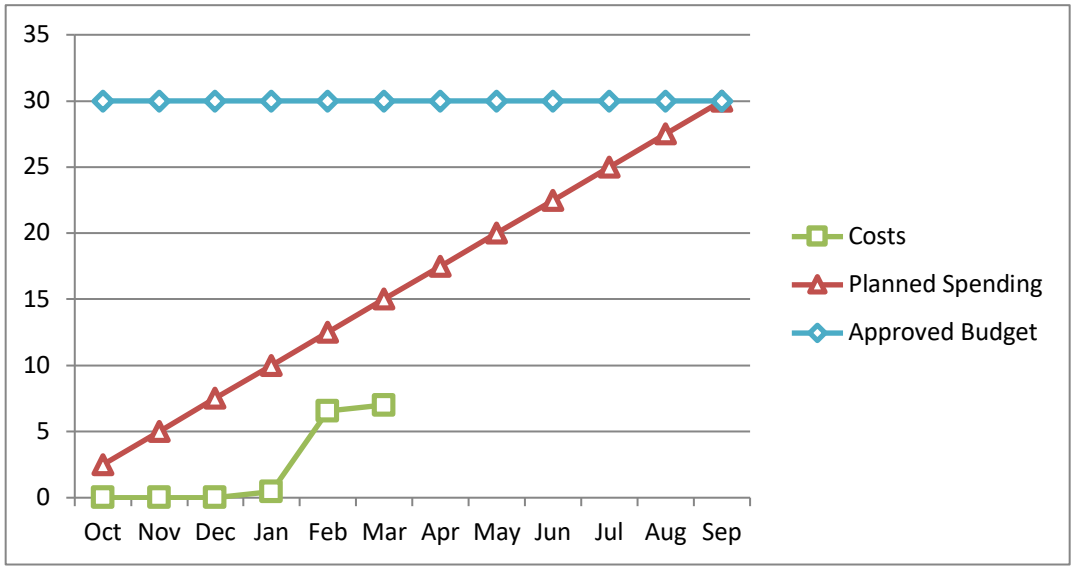
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all training activities to the NCSP Manager. (TE3)		
	Provide training in accordance with the approved schedule. (TE3)		
Q2	Provide status reports on all training activities to the NCSP Manager. (TE3)		
	Provide training in accordance with the approved schedule. (TE3)		
Q3	Provide status reports on all training activities to the NCSP Manager. (TE3)		
	Provide training in accordance with the approved schedule. (TE3)		
Q4	Provide status reports on all training activities to the NCSP Manager. (TE3)		
	Provide training in accordance with the approved schedule. (TE3)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element: LANL TE4
Task Title: On-Site Introductory Training for the NCS Practitioner on Modern Approaches to Validation using Sensitivity and Uncertainty Analysis Tools
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian Bluhm / Bob Little
Point of Contact Phone: (505) 667-2440 / (505) 665-3487

Reference: B&R DP0909010
Date of Report: May 7, 2019

BUDGET



1. **Carryover into FY 2019 = $0**
2. **Approved FY 2019 Budget = $30,000 (includes carryover)**
3. **Actual spending for 1st Quarter FY 2019 = $0**
4. **Actual spending for 2nd Quarter FY 2019 = $7,013**
5. **Actual spending for 3rd Quarter FY 2019 = $**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $0**

MAJOR ACCOMPLISHMENTS

- Sensitivity / Uncertainty Workshop scheduled for February 13-14 at Hanford was postponed by weather and re-scheduled for May 15 & 16, 2019.

NCSP Quarterly Progress Report (FY-2019 Q2)

LANL TE4 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

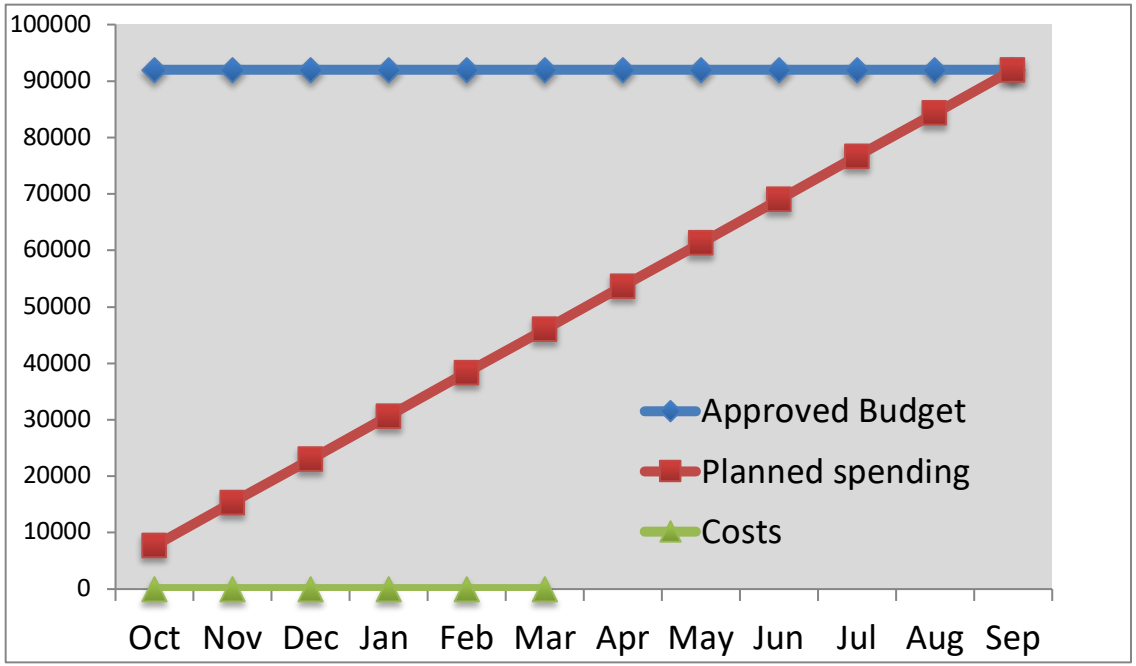
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	NONE		
Q3	NONE		
Q4	In collaboration with ORNL, provide introductory 1-day S/U workshop training to one or more DOE sites in FY19. (TE4)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element: LANL TE6
Task Title: Development of University Pipeline for Criticality Safety Professionals
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian K. Bluhm
Point of Contact Phone: (505) 667-2440

Reference: B&R DP0909010
Date of Report: May 9, 2019

BUDGET



1. **Carryover into FY 2019 = $ 0**
2. **Approved FY 2019 Budget = $ 92K**
3. **Actual spending for 1st Quarter FY 2019 = $ 0**
4. **Actual spending for 2nd Quarter FY 2019 = $ 0**
5. **Actual spending for 3rd Quarter FY 2019 = $**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $**

MAJOR ACCOMPLISHMENTS

- No Progress

NCSP Quarterly Progress Report (FY-2019 Q2)

LANL TE6 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

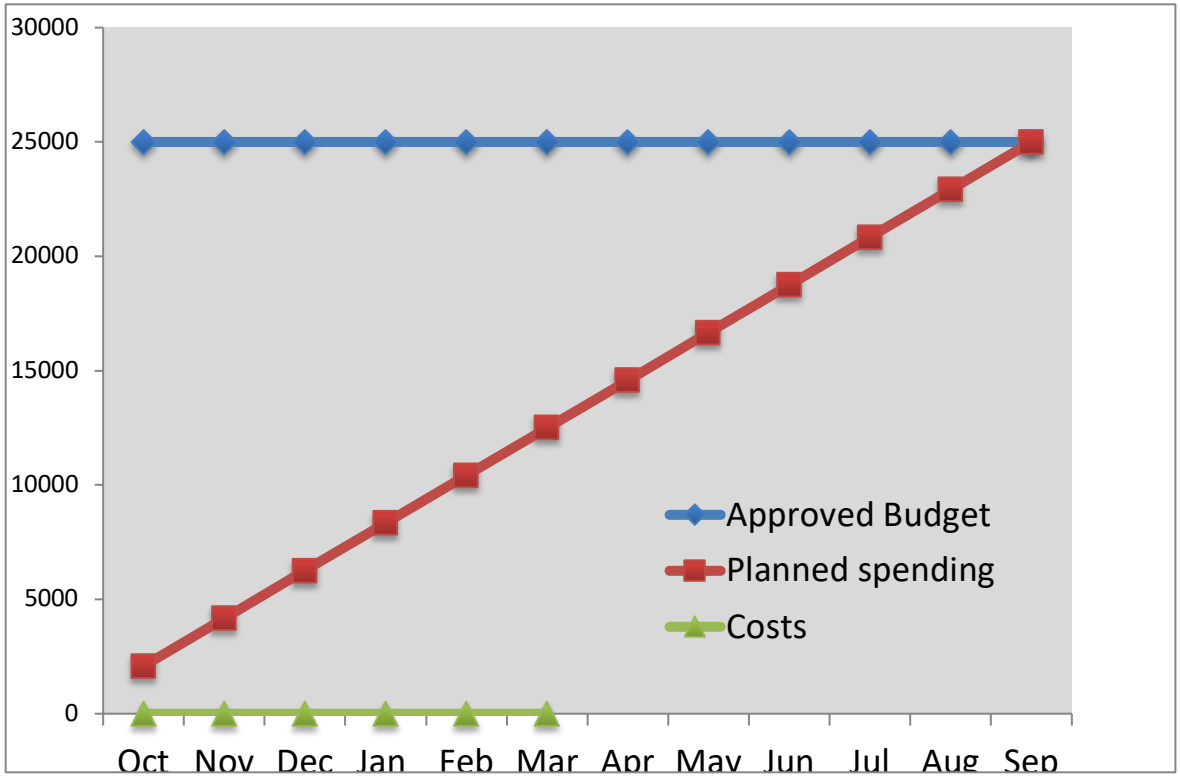
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all training activities to the NCSP Manager. (TE6)	NO REPORT	
Q2	Provide status reports on all training activities to the NCSP Manager. (TE6)	NO REPORT	**Will work with NCSD to develop plan for students**
Q3	Provide status reports on all training activities to the NCSP Manager. (TE6)		
Q4	Provide status reports on all training activities to the NCSP Manager. (TE6)		
	Provide end of year progress report. (TE6)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element: LANL TE7
Task Title: Design and Develop a New NCSP T&E Course Criticality Safety Officers at DOE/NNSA Nuclear Facilities
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian K. Bluhm
Point of Contact Phone: (505) 667-2440

Reference: B&R DP0909010
Date of Report: May 9, 2019

BUDGET



1. **Carryover into FY 2019 = $ 0**
2. **Approved FY 2019 Budget = $ 25K**
3. **Actual spending for 1st Quarter FY 2019 = $ 0**
4. **Actual spending for 2nd Quarter FY 2019 = $ 0**
5. **Actual spending for 3rd Quarter FY 2019 = $**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $ 0**

MAJOR ACCOMPLISHMENTS

- No Progress

NCSP Quarterly Progress Report (FY-2019 Q2)

LANL TE7 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

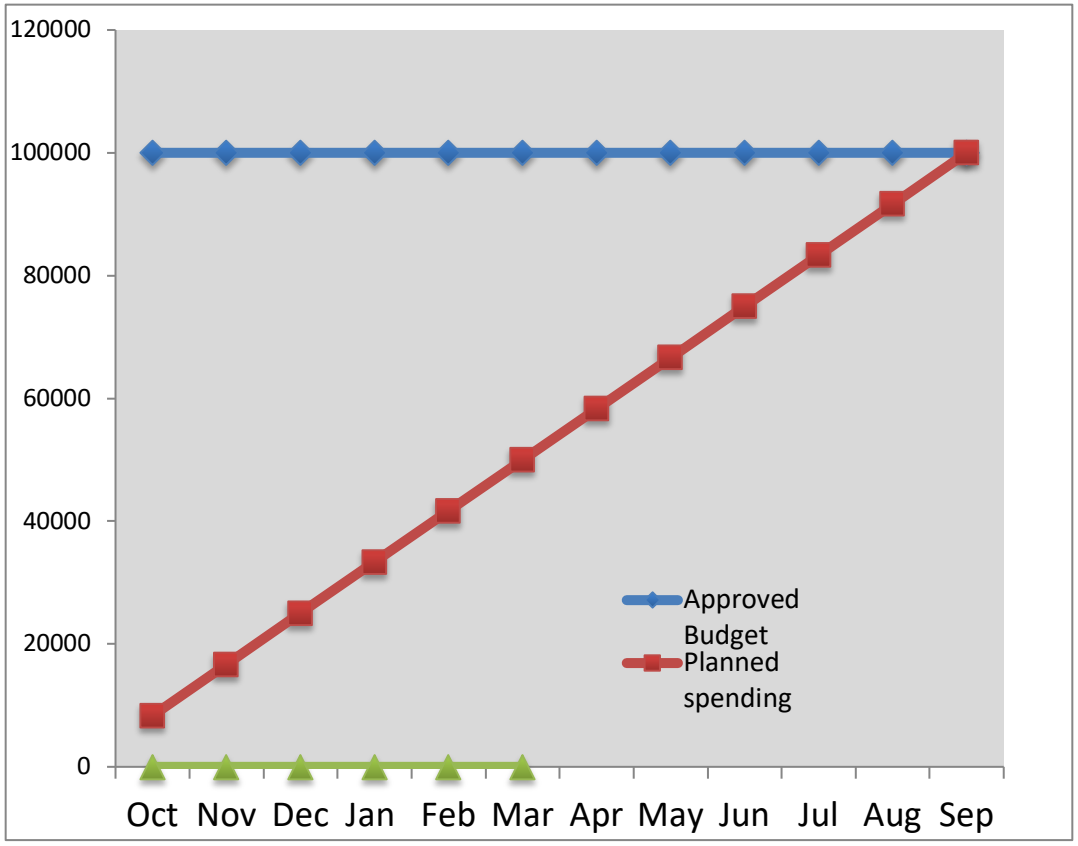
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all training activities to the NCSP Manager. (TE7)	NO REPORT	
Q2	Provide status reports on all training activities to the NCSP Manager. (TE7)	NO REPORT	
Q3	Provide status reports on all training activities to the NCSP Manager. (TE7)		
Q4	Provide status reports on all training activities to the NCSP Manager. (TE7)		
	Provide end of year progress report. (TE7)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element: LANL TE8
Task Title: Reactivity Simulation Aids
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian K. Bluhm
Point of Contact Phone: (505) 667-2440

Reference: B&R DP0909010
Date of Report: May 9, 2019

BUDGET



1. **Carryover into FY 2019 = $ 0**
2. **Approved FY 2019 Budget = $ 100K**
3. **Actual spending for 1st Quarter FY 2019 = $ 0**
4. **Actual spending for 2nd Quarter FY 2019 = $ 0**
5. **Actual spending for 3rd Quarter FY 2019 = $**
6. **Actual spending for 4rd Quarter FY 2019 = $**
7. **Projected carryover into FY 2020 = $ 0**

MAJOR ACCOMPLISHMENTS

- No Progress

NCSP Quarterly Progress Report (FY-2019 Q2)

LANL TE8 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports on all training activities to the NCSP Manager. (TE8)	NO REPORT	**Will get work planned**
Q2	Provide status reports on all training activities to the NCSP Manager. (TE8)	NO REPORT	**Will get work planned**
Q3	Provide status reports on all training activities to the NCSP Manager. (TE8)		
Q4	Provide status reports on all training activities to the NCSP Manager. (TE8)		
	Provide end of year progress report. (TE8)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtasks: TE1, 3, 8, 9

Task Titles:

TE1 Conduct Hands-on Training at the DAF (TACS)
TE3 Classroom Criticality Safety Training
TE8 Incorporate Superior Reflectors into TACS "Hands On" Training
TE9 Design and Develop a New NCSP T&E Course for Criticality Safety Officers

M&O Contractor Name: Lawrence Livermore National Laboratory

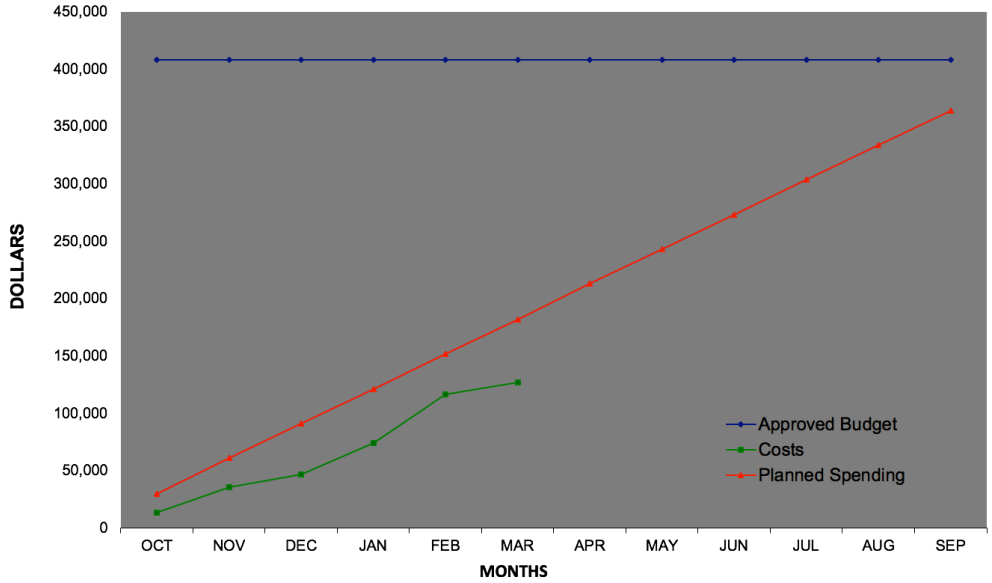
Point of Contact Name: David Heinrichs

Point of Contact Phone: (925) 424-5679

Reference: B&R DP0909010

Date of Report: May 10, 2019

BUDGET



1. **Carryover into FY 2019** = $12,541
2. **Approved FY 2019 Budget** = $408,541 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $47,065
4. **Actual spending for 2nd Quarter FY 2019**= $80,195
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $12,541 (11%)

MAJOR ACCOMPLISHMENTS

1. Provided registration and logistics support (TE1, TE3) for:
   - 2-week CSE course on Jan 28-Feb 8, 2019 at NATM & NCERC/SNL
   - 1 week Managers course on April 8-12, 2019 at SNL
   - 1 week Managers course on June 3-7, 2019 at NCERC
   - 2-week CSE course on Aug 12-23, 2019 at NATM & NCERC/SNL
   - 2-week CSE course on Jan 27-Feb 7, 2020 at NATM & NCERC/SNL
2. Presented "New Emergency Response/Sliderule Module for NCSP Hands-On Course" at the NCSP TPR on March 26, 2019 (TE1).
3. Provided academic and hands-on instruction for the two-week CSE course at NATM and NCERC on January 28-February 8, 2019 including the following modules:
   - NCS Fundamentals
   - NCS Evaluation
   - Evaluation Workshops
   - Introduction to Experimental Methods
   - TACS
   - Emergency Response
4. Participated in all T&E teleconferences (TE1, TE3).
5. The CSE for adding Be to the TACS is in final review with completion next quarter (TE8).
6. Participated in discussions, telecons and a face-to-face meeting on March 25, 2019 regarding the design and development of a new NCSP T&E course for criticality safety officers (TE9).

NCSP Quarterly Progress Report (FY-2019 Q2)

LLNL T&E Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

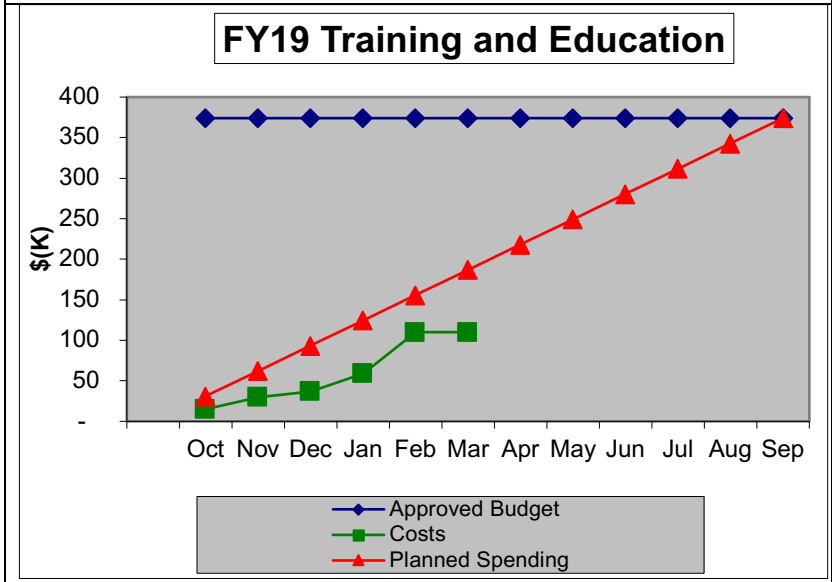
QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager (TE1, TE3).		
	Conduct subcritical measurements using beryllium shells and finalize training materials addressing the concept of superior reflection. (TE8)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		
Q2	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager (TE1, TE3).		
	Conduct subcritical measurements using beryllium shells and finalize training materials addressing the concept of superior reflection. (TE8)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		**Participated in CSSG 2018-1 including correspondence, tele-cons, and one face-to-face meeting.**
Q3	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager (TE1, TE3).		
	Conduct subcritical measurements using beryllium shells and finalize training materials addressing the concept of superior reflection. (TE8)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		
Q4	Update, maintain and support the registration process and provide classroom and "hands on" TACS training in accordance with the schedule approved by the NCSP Manager (TE1, TE3).		
	Conduct subcritical measurements using beryllium shells and finalize training materials addressing the concept of superior reflection. (TE8)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: TE1, 5, 9, 10
Task Title: See last page
M&O Contractor Name: ORNL
Point of Contact Name: Doug Bowen
Point of Contact Phone: (865) 576-0315

Reference: DP0901010/ORNL
Date of Report: April 29, 2019

BUDGET



Notes:

1. **Carryover into FY19 = 40K**
2. **Approved Budget FY19 = 374K (includes carryover)**
3. **Actual spending for 1st Quarter FY19 = 37K**
4. **Actual spending for 2nd Quarter FY19 = 73K**
5. **Actual spending for 3rd Quarter FY19 = 0K**
6. **Actual spending for 4th Quarter FY19 = 0K**
7. **Projected carryover into FY 2020 = $0K**

MAJOR ACCOMPLISHMENTS

TE1 - Manage and Provide Instruction for the DOE Nuclear Criticality Safety Training & Education Program

- Coordinated and executed the 2-week hands-on training course at the Nevada Field Office, Sandia National Laboratory, and the National Criticality Experiments Research Center from Jan. 28-Feb. 8, 2019. Doug Bowen, Angela Lousteau, B.J. Marshall, Lori Scott, and Jerry Hicks participated in the course. All course materials were archived on the NCSP T&E SharePoint, e.g., exams, photographs, course materials, and student evaluation forms. Angela Lousteau attended both weeks to assist with her NDA module updates to support the course.
- Late in Q2, telecons to prepare for the 1-week Manager's Course at Sandia National Laboratory planned and conducted.

TE5 - On-Site Introductory Training for the NCS Practitioner on Modern Approaches to Validation using Sensitivity and Uncertainty Analysis Tools

- Worked with LANL (Brown, Alwin, Rising) and with Hanford (Alyssa Kersting) to schedule, plan, and arrange the next S/U course. This is currently scheduled over a 2-day period due to the needs of two organizations at Hanford. 12-18 students plan to attend. The course will be located at the HAMMER facility in North Richland and will be conducted May 15-16, 2019. This course was originally scheduled in FY19Q2 but had to be postponed until May due to a snowstorm in Richland.

TE9 - Design and Develop a New NCSP T&E Course for Criticality Safety Officers at DOE/NNSA Nuclear Facilities

- This task is pending completion of the 2018-01 CSSG tasking report. At the time of this report, the tasking report has been drafted and has been sent out for review amongst the CSSG CSO training course team. Anticipate the actual design work starting in mid- to late-Q3. Doug Bowen has been working on the CSSG team on the tasking.

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: TE1, 5, 9, 10 **Task Title:** See last page **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0901010/ORNL **Date of Report:** April 29, 2019
	TE10 - Design of a Subcritical Assembly at ORNL for use with the CSO/FMH Courses • Computations continue for this task. Multiple AGN 201 core pieces have been located at Y-12. Q2 work will be to identify a complete set of fuel plates for use at ORNL for the subcritical assembly. A design report will be completed in Q4 for the sake of an FY2021 proposal to continue the development of a prototype for subcritical measurements at ORNL. ORNL management have provided $80k in program development funds to explore a facility location for the subcritical assembly once it is constructed. Local universities have expressed great interest in this new facility/capability that is being explored at ORNL.

NCSP Quarterly Progress Report (FY-2019 Q2)

ORNL TE Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
			

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)		
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)		
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		
Q2	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)		
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)		
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		

Q3	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)		
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)		
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		
Q4	Provide a status report in NCSP Quarterly Progress Reports on implementation of the NCS training program and resolution of CSSG comments from CSSG tasking 2016-01. (TE1)		
	Provide status reports in NCSP Quarterly Progress Reports on improvements/modifications to baseline NCS course training materials based on CSSG assessment report 2016-01, self-evaluation, and feedback from reviewers, observers, trainers, and the NCSP manager. (TE1)		
	Provide a status report in NCSP Quarterly Progress Reports on the progress of 1-day onsite introductory validation training conducted at one or more DOE sites. (TE5)		
	Provide a status report of the status of efforts to develop a new CSO/FMH course for the NCSP for piloting in FY20. (TE9)		
	Develop a feasibility report to the NCSP manager for the design and installation of a subcritical assembly at ORNL using existing resources at Y-12. If the concept is feasible, submit a proposal for consideration for FY20. (TE10)		

NCSP Quarterly Progress Report (FY-2019 Q2)

Task Title:

TE1 Manage and Provide Instruction for the DOE Nuclear Criticality Safety Training & Education Program

TE5 On-Site Introductory Training for the NCS Practitioner on Modern Approaches to Validation using Sensitivity and Uncertainty Analysis Tools

TE9 Design and Develop a New NCSP T&E Course for Criticality Safety Officers at DOE/NNSA Nuclear Facilities

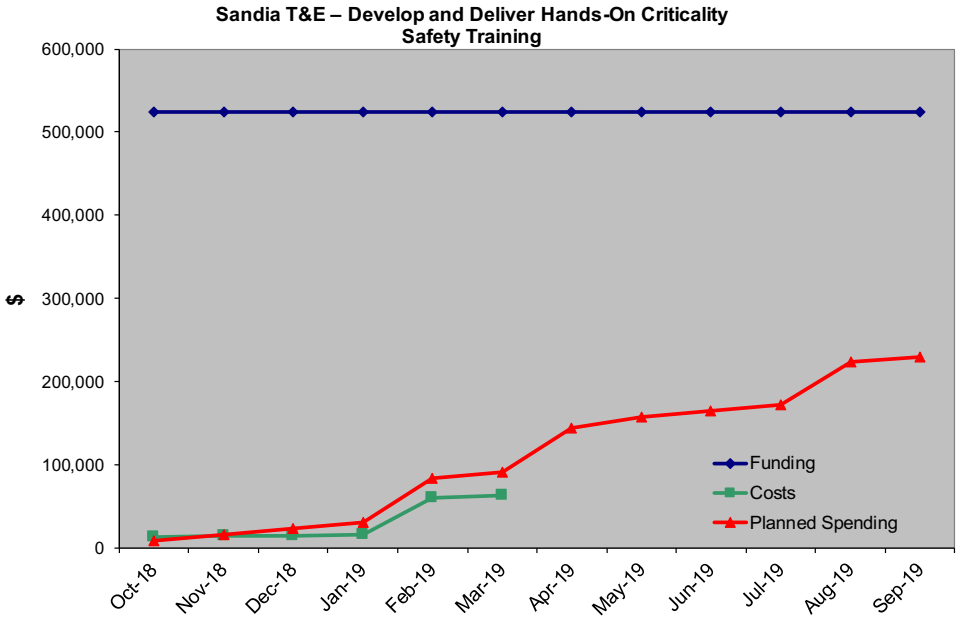
TE10 Design of a Subcritical Assembly at ORNL for use with the CSO/FMH Courses

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element: SNL TE1, 2
Task Titles:
TE1 Prepare for and Conduct Hands-on Criticality Safety Training at SNL
TE2 Design and Develop a New NCSP T&E Course Criticality Safety Officers at DOE/NNSA Nuclear Facilities
M&O Contractor Name: Sandia National Laboratories (SNL)
Point of Contact Name: Gary A. Harms
Point of Contact Phone: (505)845-3244

Reference: B&R DP 0909010
Date of Report: April 30, 2019

BUDGET



1. **Carryover into FY 2019** = $295,351
2. **Approved FY 2019 Budget** = $229,000 (new) + $295,351 (carryover) = $524,351
3. **Actual spending for 1st Quarter FY 2019** = $13,447
4. **Actual spending for 2nd Quarter FY 2019** = $62,395
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4th Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $

MAJOR ACCOMPLISHMENTS

- We supported the delivery of the classroom portion of a Hands-On criticality safety course for NCSEs in January/February 2019 in Nevada
- We delivered the experimental portion of a Hands-On criticality safety course for NCSEs in February 2019 at Sandia
- We are preparing to deliver a Hands-On criticality safety course for managers in April 2019

NCSP Quarterly Progress Report (FY-2019 Q2)

SNL T&E Milestones:

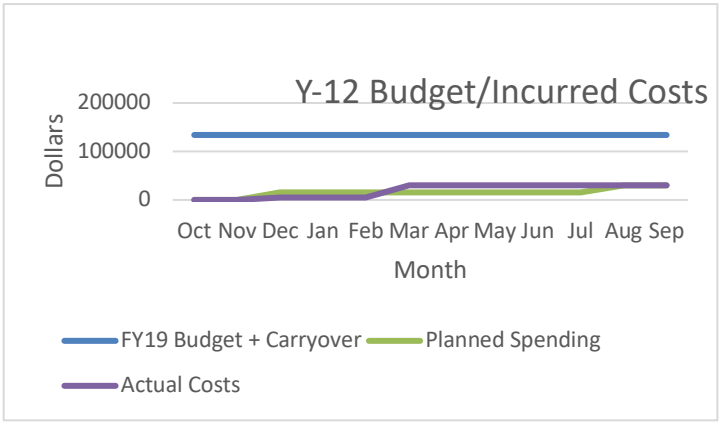
STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the LANL training classes in accordance with the approved schedule. (TE1)		
	Work with LLNL, ORNL, LANL to develop and deploy a 1-week hands-on NCSP T&E course for fissile material handlers and criticality safety officer. (TE2)		
Q2	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the LANL training classes in accordance with the approved schedule. (TE1)		
	Work with LLNL, ORNL, LANL to develop and deploy a 1-week hands-on NCSP T&E course for fissile material handlers and criticality safety officer. (TE2)		
Q3	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the LANL training classes in accordance with the approved schedule. (TE1)		
	Work with LLNL, ORNL, LANL to develop and deploy a 1-week hands-on NCSP T&E course for fissile material handlers and criticality safety officer. (TE2)		
Q4	Conduct hands-on training classes at Sandia and provide Human Factors and Equipment Reliability module support to the LANL training classes in accordance with the approved schedule. (TE1)		
	Work with LLNL, ORNL, LANL to develop and deploy a 1-week hands-on NCSP T&E course for fissile material handlers and criticality safety officer. (TE2)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtasks: Y12 TE1, 3, 4 **Task Title:** TE1 Conduct Hands-On Criticality Safety Training Course (Lecture support week 1 of 2-week hands-on course and course material development) TE3 Design of a Subcritical Assembly at ORNL for use with the CSO Courses TE4 Design and Develop a New NCSP T&E Course for Criticality Safety Officers at DOE/NNSA Nuclear Facilities **M&O Contractor Name:** Y12 **Point of Contact Name:** Kevin Reynolds **Point of Contact Phone:** (865) 241-9067	**Reference: B&R DP0909010** **Date of Report: May 23, 2019**
BUDGET	**MAJOR ACCOMPLISHMENTS**



1. **Carryover into FY 2019** = $0
2. **Approved FY 2019 Budget** = $134k (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $5,394.30
4. **Actual spending for 2nd Quarter FY 2019** = $24,750.20
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $

- TE1 is Chris Haught's time to teach at TAMU and Hands On Courses. Minimal effort in Q1 – mostly prep for TAMU teaching which is to occur in Q2.
- TE3 and TE4 are ORNL tasks we fund as requested and so far no effort from us on these items has occurred.
- Q2 for TE1: Teaching prep for TAMU.
- Q2 for TE3 and TE4 are zero effort to date.

NCSP Quarterly Progress Report (FY-2019 Q2)

Y12 TE Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

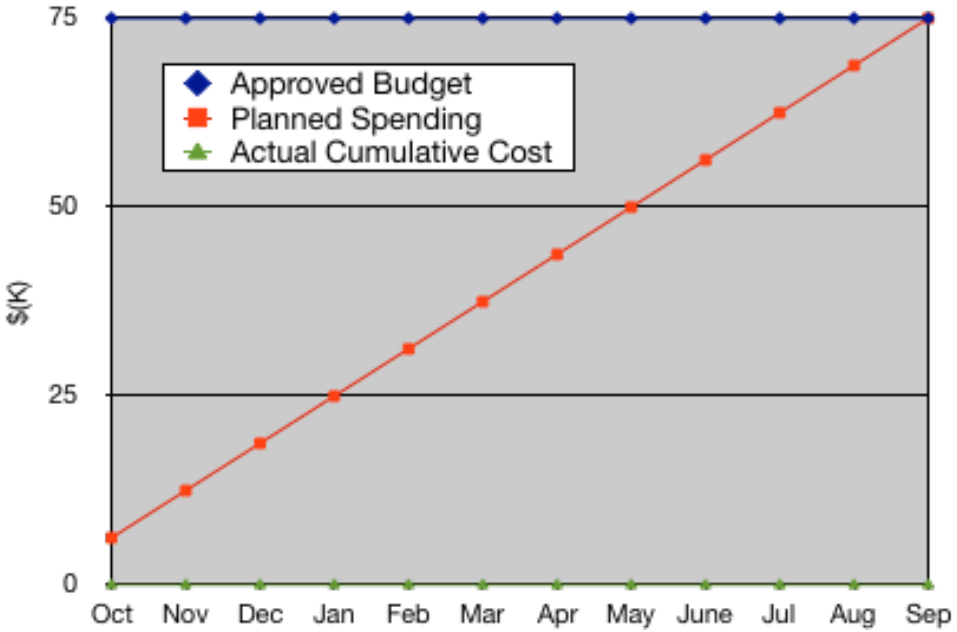
Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	COMMENTS
Q1	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1, TE3, TE4)		
Q2	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1, TE3, TE4)		
Q3	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1, TE3, TE4)		
Q4	Conduct hands-on training classes at NFO and NCERC to support the training classes in accordance with the approved schedule. (TE1, TE3, TE4)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: NCSP Technical Support TS6 Task Title: ND Succession Planning M&O Contractor Name: BNL Point of Contact Name: David Brown Point of Contact Phone: 631-344-2814	Reference: DP0909010 Date of Report: May 14, 2019

BUDGET



1. **Carryover into FY 2019** = $ 0
2. **Approved FY 2019 Budget** = $75 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $0
4. **Actual spending for 2nd Quarter FY 2019** = $0
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $0

ACCOMPLISHMENTS

Work on this task has not yet begun this FY.

NCSP Quarterly Progress Report (FY-2019 Q2)

BNL TS6 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
			

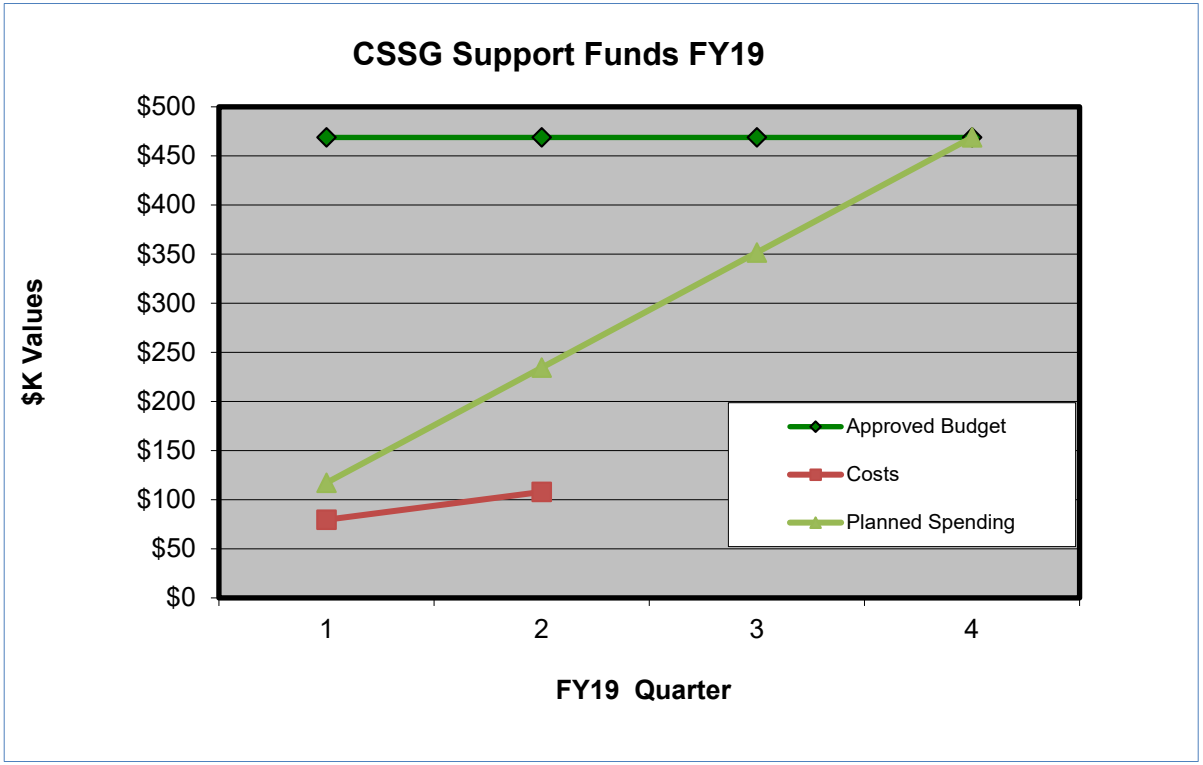
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		**n/a**
Q2	NONE		
Q3	NONE		
Q4	Provide NCSP Manager annual report of succession planning efforts.		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: TS1
Task Title: CSSG Support
M&O Contractor Name(s): AECOM, ANL, LANL, LLNL, PNNL, SRNS, Y-12
Point of Contact Name: David Hayes (CSSG Deputy Chair)
Point of Contact Phone: 505-667-4523

Reference: B&R DP 0909010
Date of Report: May 8, 2019

BUDGET



1. **Carryover into FY 2019** = $k 48.8
2. **Approved FY 2019 Budget** = $k 468.8 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $k 79.6
4. **Actual spending for 2nd Quarter FY 2019** = $k 28.3
5. **Actual spending for 3rd Quarter FY 2019** = $k
6. **Actual spending for 4rd Quarter FY 2019** = $k
7. **Projected carryover into FY 2020** = $ 0

MAJOR ACCOMPLISHMENTS

- Tasking 2018-01 ongoing
- CSSG Face-to-Face meeting in Amarillo
- Tasking 2019-01
- Regular CSSG Telecons

NCSP Quarterly Progress Report (FY-2019 Q2)

CSSG TS Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

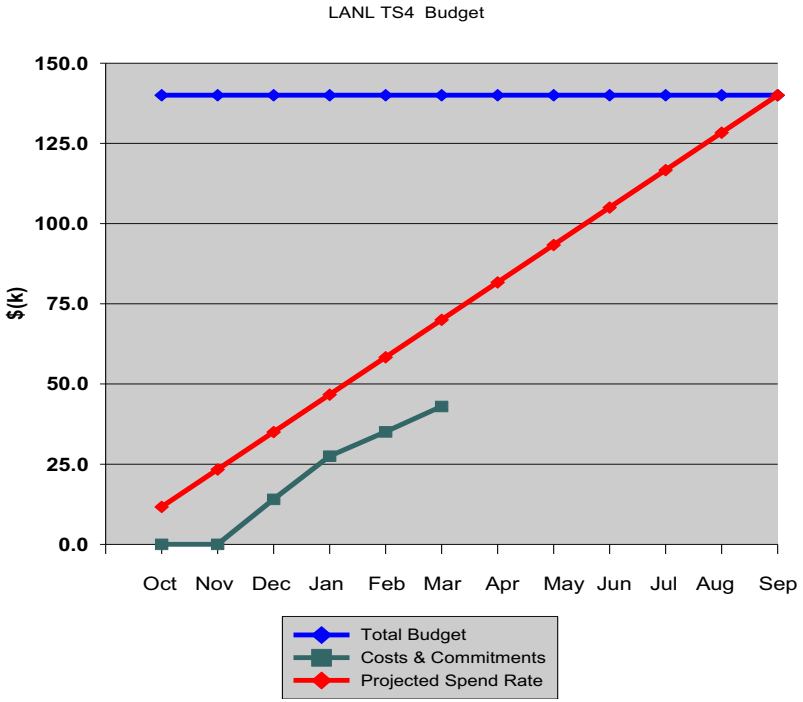
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)		**Tasking 2018-01 not complete. Team refocused with expected completion by end of Q2.**
Q2	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)		**Tasking 2018-01 not complete. Team refocused with expected completion by end of Q3. Tasking 2019-01 underway. Expected completion early Q3.**
Q3	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)		
Q4	Provide the NCSP manager with a summary of CSSG activities, meetings, and tasks. (TS1)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element: LANL TS4
Task Title: AM, IE, ND Succession Planning
M&O Contractor Name: Los Alamos National Laboratory (LANL)
Point of Contact Name: Brian Bluhm
Point of Contact Phone: (505) 667-2440

Reference: B&R DP0909010
Date of Report: May 10, 2019

BUDGET



1. **Carryover into FY 2019** = $ 0
2. **Approved FY 2019 Budget** = $ 140K
3. **Actual spending for 1st Quarter FY 2019** = $14.0K
4. **Actual spending for 2nd Quarter FY 2019** = $29.0K
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020** = $

MAJOR ACCOMPLISHMENTS

Jennifer Arthur

• Performed work on the subcritical validation suite.

• Updated the subcritical benchmark genetic algorithm to include the ENDF/B-VIII.0 cross-section library.

NCSP Quarterly Progress Report (FY-2019 Q2)

LANL TS4 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
			

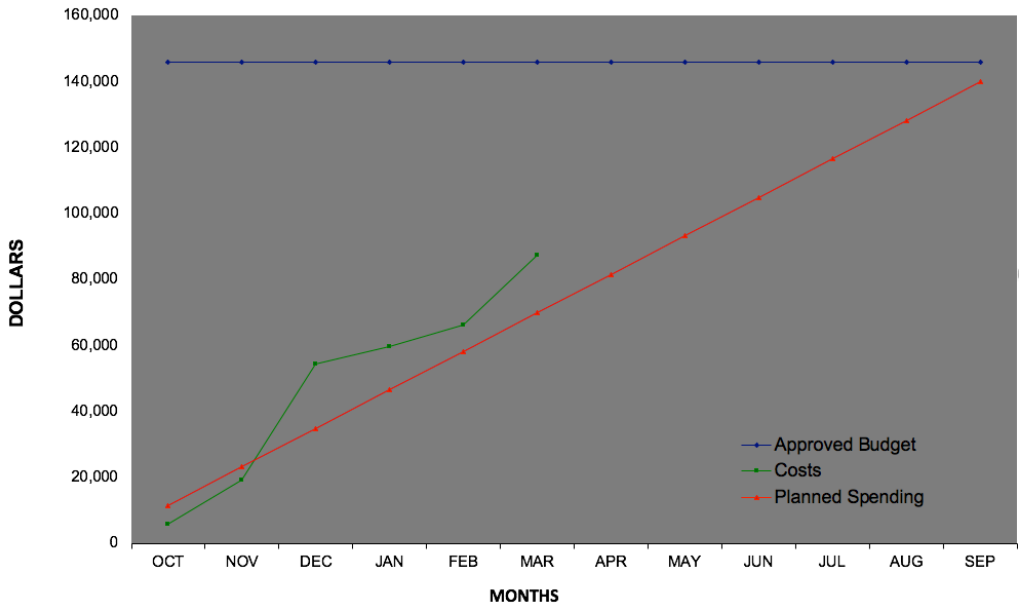
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	NONE		
Q3	NONE		
Q4	Provide NCSP Manager annual report of succession planning efforts.		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtasks: TS5
Task Title: LLNL Succession Planning
M&O Contractor Name: Lawrence Livermore National Laboratory
Point of Contact Name: David Heinrichs
Point of Contact Phone: (925) 424-5679

Reference: B&R DP0909010
Date of Report: May 10, 2019

BUDGET



1. **Carryover into FY 2019** = $6,086
2. **Approved FY 2019 Budget** = $146,086 (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $54,353
4. **Actual spending for 2nd Quarter FY 2019**= $33,114
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $6,086 (4%)

MAJOR ACCOMPLISHMENTS

1. Jim Reus has re-established access to iSRD and obtained code development privileges for LLNL multiphysics software and re-ran a subset of prompt supercritical (metal) cases (AM).
2. Shauntay Coleman and Jesse Norris attended ME 690, "Radiation and Nuclear Criticality Analysis of RAM Packages Safety" at ORNL on March 4-8, 2019 (AM).
3. Daniel Stone replaced Dave Hickman (retired) as the technical SME for NADs and presented *Intercomparison of Nuclear Accident Dosimetry using the Flattop Reactor at NCERC* at the NCSP TPR on March 27, 2019 (IE).
4. LLNL interviewed a candidate on March 18, 2019, for a Postdoctoral research appointment from the Paul Scherrer Institut, Switzerland (IE).
5. Re-established a subcontract with C.S. Engineering, Inc., with Mark Lee (LFO, retired) replacing Allan Krass (at Y-12).
6. Jason Burke replaced Brad Sleaford (retired) as SME for thermal neutron radiative capture gamma emission spectroscopy. This period work continued in assessing the feasibility of a US alternative to the Budapest Neutron Center for this type of measurement (ND).

LLNL TS5 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
			

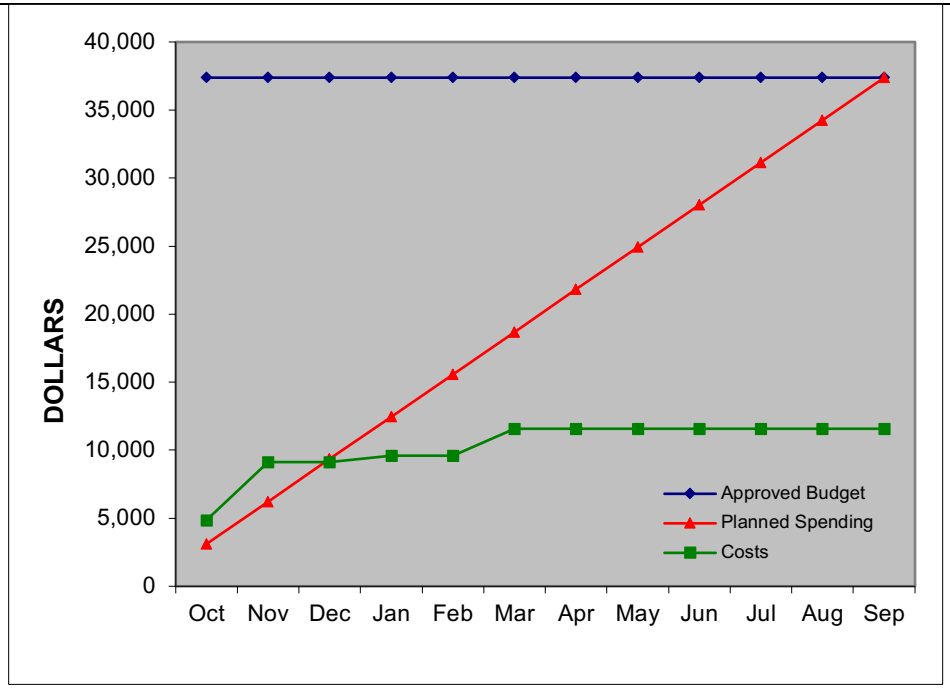
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	NONE		
Q3	NONE		
Q4	Provide NCSP Manager annual report of succession planning efforts.		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtasks: NNL TS9
Task Title: NNL – Support for NDAG Chair activities
M&O Contractor Name: NNL
Point of Contact Name: Mike Zerkle
Point of Contact Phone: (412) 476-6188

Reference: B&R DP0909010
Date of Report May 23, 2019

BUDGET



1. **Carryover into FY 2019** = $8k
2. **Approved FY 2019 Budget** = $37k (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $9k
4. **Actual spending for 2nd Quarter FY 2019** = $3k
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4rd Quarter FY 2019** = $
7. **Projected carryover into FY 2020 =** $ (0%)

MAJOR ACCOMPLISHMENTS

1. Supported planning for Jan 2019 WANDA meeting as NDAG Chair, WANDA participation cancelled due to family emergency.
2. Performed NDAG membership election, BJ Marshall elected to the open slot on NDAG.
3. Performed NDAG Chair technical review of NCSP FY2020 IE and ND proposals, provided results to CSSG and NCSP Management Team.
4. Performed NDAG technical review of FY2018 and FY2019 IE proposals, provided results to NCSP Management Team.
5. Participated in FY2020 NCSP proposal review by CSSG as NDAG Chair.
6. Participated in March 2019 NCSP Technical Program Review as NDAG Chair.
7. Chaired March 2019 NDAG meeting following TPR, discussed updates to Appendix B in preparation for the FY2020 Budget Execution Meeting.
8. Performed ICSBEP and IRPhEP benchmark evaluation reviews in support of the publication of the 2019 edition of these handbooks.
9. CEdT process support as NDAG Chair and CEdT Team Member for:
    a. IER-184 (TEX Pu/Ta) CED-3b
    b. IER-299 (KRUSTY Cold/Warm Test) CED-3b
    c. IER-480 (TEX Poly & Lucite Moderated) CED-1
    d. IER-230 (7uPCX w/ Optimal Moderation) CED-2
    e. IER-451 (LEU-COMP-THERM-099) CED-4b
    f. IER-489 (Curie) CED-2
    g. IER-206 (BUCCX w/ Rh) CED-4b
    h. IER-297 (TEX HEU/Hf) CED-3a
    i. IER-441 (7uPCX w/ Ta) CED-2

NCSP Quarterly Progress Report (FY-2019 Q2)

NNL TS9 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

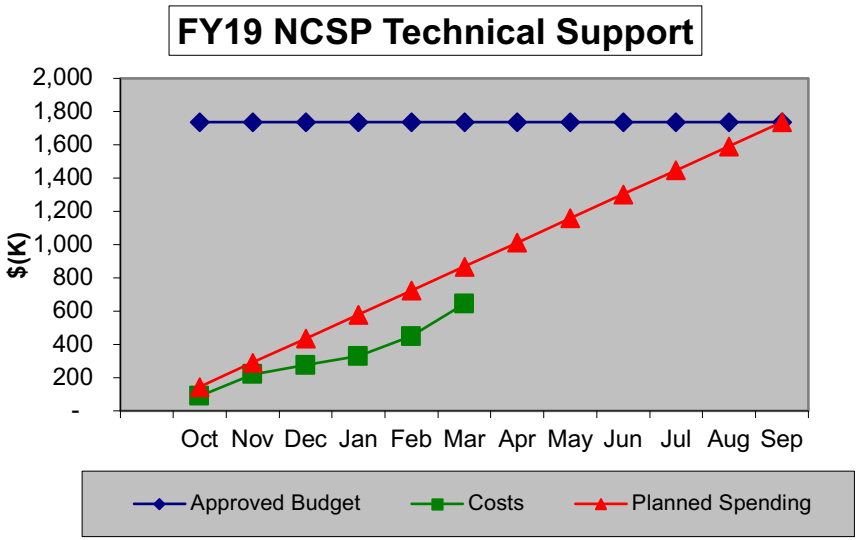
QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide the NCSP manager with a summary of NDAG chair activities, meetings, and tasks. (TS9)		
Q2	Provide the NCSP manager with a summary of NDAG chair activities, meetings, and tasks. (TS9)		
Q3	Provide the NCSP manager with a summary of NDAG chair activities, meetings, and tasks. (TS9)		
Q4	Provide the NCSP manager with a summary of NDAG chair activities, meetings, and tasks. (TS9)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: TS2 (NCSP Technical Support), TS7 (Succession Planning), TS8 (NCSP MGT Tool Development), TS11 (CEdT Manager Support)
M&O Contractor Name: ORNL
Point of Contact Name: Doug Bowen
Point of Contact Phone: (865) 576-0315

Reference: DP0902000/ORNL
Date of Report: May 2, 2019

BUDGET



1. **Carryover into FY 2019** = $613K
2. **Approved FY 2019 Budget** = $ 1737K (includes carryover)
3. **Actual spending for 1st Quarter FY 2019** = $275K
4. **Actual spending for 2nd Quarter FY 2019** = $369K
5. **Actual spending for 3rd Quarter FY 2019** = $0K
6. **Actual spending for 4rd Quarter FY 2019** = $0K
7. **Projected carryover into FY 2020 = $~150K (G2 programming)**

MAJOR ACCOMPLISHMENTS

TS2

- Prepare and maintain elements of NCSP Plan and associated activities:
  - Monitor Five-Year Plan progress,
  - Review/revise task list, and
  - Schedule/participate in meetings and teleconferences.
  - Manage and provide oversight/coordinate efforts for the NCSP Information, Preservation, and Dissemination task element.
  - Manage and provide oversight/coordinate efforts for the NCSP Training and Education Program task element.
- Participated in NCSP management team and other NCSP-related meetings, as required by the NCSP Manager.
- Prepared Q1 QPRs into a single bookmarked PDF file for use in QPR. Conducted Q1 telecon.
- Worked with Mission and Vision team leads to complete their draft Mission and Vision sections. Compiled final draft of the document.
- Completed preliminary task list along with the 43 new proposals for FY20. Prepared a status spreadsheet of FY19 completed tasks for the CSSG to perform their rankings of proposed tasks. Worked with NDAG to vet the ND and IE tasks for FY20. NDAG was also tasked with vetting the IE proposals for FY18/19 to ensure all IE tasks had the required NDAG review. The task list will be updated with this information. A new planning calendar was created to address the changes to the new NCSP planning process.
- Participated in CSSG telecons and assisted with CSSG tasks as necessary. Doug Bowen supporting CSSG tasking 2018-01 CSO course baseline.
- Finalized efforts to improve documentation of NCSP accomplishments to ensure NCSP work is linked to final 5YP milestones. Lori Scott has created new quarterly reporting templates for distribution to the site task managers.
- Led and participated in IE WebEx meetings in October and December
- Planned, coordinated, and executed the TPR at Pantex the week of March 25th. Meetings conducted this week included the CSSG meeting, TPR, NDAG, Analytical Methods working group, and others.

TS7

- Chris Chapman continued to work on nuclear data evaluations with Vlad Sobes as a mentor, in particular, the Ce nuclear data evaluations. Chris is also working on thermal neutron scattering measurements at the ORNL SNS. Andrew Holcomb continued working on tasks to utilize SAMMY and AMPX for NCSP projects. Plan

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtask: TS2 (NCSP Technical Support), TS7 (Succession Planning), TS8 (NCSP MGT Tool Development), TS11 (CEdT Manager Support) **M&O Contractor Name:** ORNL **Point of Contact Name:** Doug Bowen **Point of Contact Phone:** (865) 576-0315	**Reference:** DP0902000/ORNL **Date of Report:** May 2, 2019
	to use this new funding to partially support two new staff members at ORNL for NCSP work. **TS8** • ORNL continued work on an initial prototype of a new NCSP Program Management Tool. Bowen supported multiple meetings with G2 programmers to discuss desired IER database features for the May 2019 G2 campaign. A prototype may be ready in Q3. **TS11** • ORNL conducted monthly integral experiment telecons in January and February. There was no telecon in March. Planning coordinated with Brian Bluhm for the face-to-face IE meeting at LANL in April 2019. • The C_EDT manager tracked IER products and Baseline Change Reviews and worked with the NCSP manager to approve tasks, as required. • John Miller (Sandia) was announced as the new CEdT Manager and will be transitioning into this role throughout the summer. Bowen spent time with Miller to provide some introductory training on the NCSP and the CEdT role.

NCSP Quarterly Progress Report (FY-2019 Q2)

ORNL TS Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)		
	Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. (TS2)		
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)		
Q2	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)		
	Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. (TS2)		
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)		
Q3	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)		
	Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. (TS2)		

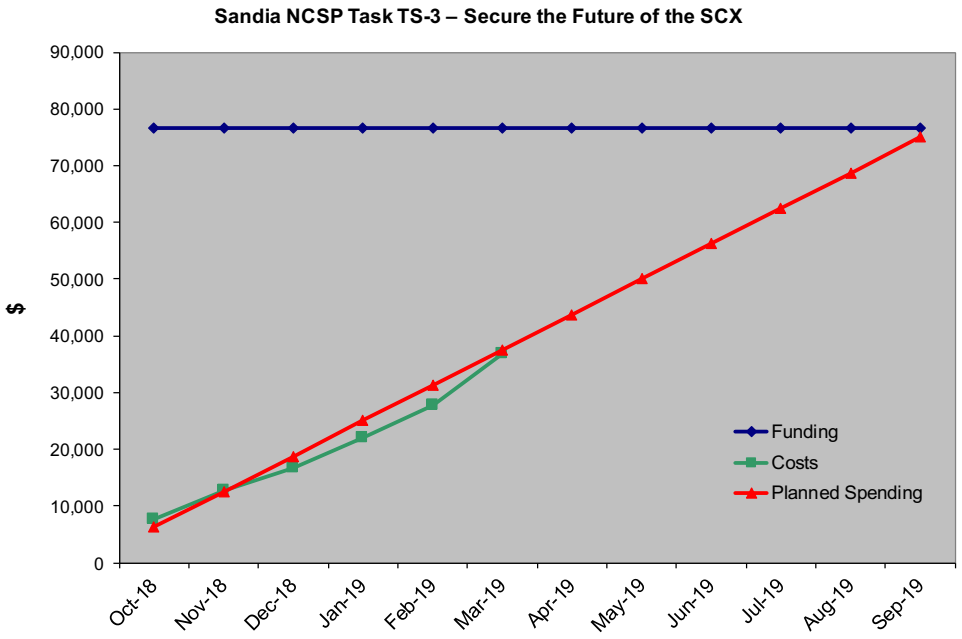
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)		
Q4	Manage C_EdT process and coordinate execution of planned IERs each FY. (TS2)		
	Maintain up-to-date spreadsheet of proposed tasks for NCSP Manager after the NCSP proposal review meeting and through the final task prioritization effort by the NCSP Management Team. (TS2)		
	Provide the NCSP manager with a summary of NCSP IE task TS11 as described in the task description. (TS11)		
	Participate in Q4 Budget Execution Meeting and assist NCSP Manager in finalization of approved tasks for next FY. (TS2)		
	Publish final Five-Year Plan. (TS2)		
	Provide NCSP Manager annual report of succession planning efforts. (TS7)		
	Provide NCSP Manager a status report of progress on the development of a program management tool. (TS8)		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element: SNL TS3
Task Title: Support for Experimentalist Succession Planning
M&O Contractor Name: Sandia National Laboratories (SNL)
Point of Contact Name: Gary A. Harms
Point of Contact Phone: (505)845-3244

Reference: B&R DP 0909010
Date of Report: April 30, 2019

BUDGET



1. **Carryover into FY 2019** = $1,682
2. **Approved FY 2019 Budget** = $75,000 (new) + $1,682 (carryover) = $76,682
3. **Actual spending for 1st Quarter FY 2019** = $16,753
4. **Actual spending for 2nd Quarter FY 2019** = $36,771
5. **Actual spending for 3rd Quarter FY 2019** = $
6. **Actual spending for 4th Quarter FY 2019** = $
7. **Projected carryover into FY 2020** = $

MAJOR ACCOMPLISHMENTS

- We have a matrixed employee who is being trained as an experimenter.
- The new experimenter has been executing and documenting the IER-451 experiments. The evaluation LEU-COMP-THERM-099 that documents the experiments is nearly ready for publication.
- The new experimenter has taken the lead role on the CEdT for IER-230.
- The new experimenter has been actively participating in the NCS community by attending conferences and publishing papers.

NCSP Quarterly Progress Report (FY-2019 Q2)

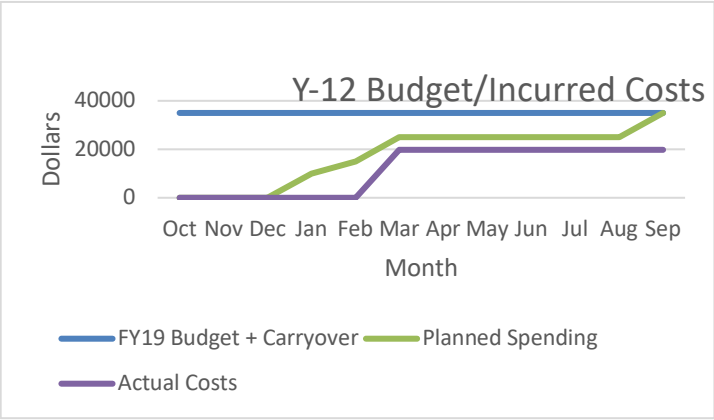
SNL TS3 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone
			

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	NONE		
Q2	NONE		
Q3	NONE		
Q4	Provide NCSP Manager annual report of succession planning efforts.		

NCSP Quarterly Progress Report (FY-2019 Q2)

NCSP Element and Subtasks: Y12 TS10 **Task Title:** TPR and Foreign Travel **M&O Contractor Name:** Y12 **Point of Contact Name:** Kevin Reynolds **Point of Contact Phone:** (865) 241-9067	**Reference: B&R DP0909010** **Date of Report: May 23, 2019**
BUDGET	**MAJOR ACCOMPLISHMENTS**
 1. **Carryover into FY 2019** = $0 2. **Approved FY 2019 Budget** = $35k (includes carryover) 3. **Actual spending for 1st Quarter FY 2019** = $0 4. **Actual spending for 2nd Quarter FY 2019** = $19,790.34 (TPR) 5. **Actual spending for 3rd Quarter FY 2019** = $ 6. **Actual spending for 4rd Quarter FY 2019** = $ 7. **Projected carryover into FY 2020 =** $	• Q1: Abstracts for ICNC drafted and submitted for two papers to be presented in support of NCSP funding. • Q1: TPR arrangements begun (ongoing) • Q2: TPR planning complete and meeting held at Pantex

NCSP Quarterly Progress Report (FY-2019 Q2)

Y12 TS10 Milestones:

STATUS (copy color code and paste below in 'STATUS' field)

Complete	On Schedule	Behind Schedule	Missed Milestone

QUARTER	MILESTONE	STATUS	ISSUES/PATH FORWARD
Q1	Provide status reports all TPR hosting activities in NCSP Quarterly Progress Reports. (TS10)		
Q2	Provide status reports all TPR hosting activities in NCSP Quarterly Progress Reports. (TS10)		Original budget was for TPR and 2 trips to ICNC 2019. I believe Angela approved a third trip (Kristen Wessels) and so we will need additional funds to cover this trip. TPR was under budget by almost $6k
Q3	Provide status reports all TPR hosting activities in NCSP Quarterly Progress Reports. (TS10) – only if still applicable		
Q4	Provide status reports all TPR hosting activities in NCSP Quarterly Progress Reports. (TS10) – only if still applicable		
	Provide Foreign Trip Report for ICNC. (TS10)		

Summary of NDAG Chair Activities during FY2019 Q2

May 23, 2019

M. L. Zerkle

This report provides a summary of the NDAG Chair activities, meetings, and tasks during the second quarter of FY2019 (1/1/2019 to 3/31/2019).

1. Supported planning for Jan 2019 WANDA meeting as NDAG Chair, my participation at WANDA was cancelled due to a family emergency.
2. Performed a NDAG membership election to fill the open slot created following Mark Williams (ORNL) passing, BJ Marshall (ORNL) was elected.
3. Performed NDAG Chair technical review of NCSP FY2020 IE and ND proposals, provided results to CSSG and NCSP Management Team.
4. Performed NDAG technical review of FY2018 and FY2019 IE proposals, provided results to NCSP Management Team.
5. Participated in FY2020 NCSP proposal review by CSSG as NDAG Chair.
6. Participated in March 2019 NCSP Technical Program Review as NDAG Chair.
7. Chaired March 2019 NDAG meeting following TPR, discussed updates to Appendix B in preparation for the FY2020 Budget Execution Meeting.
8. Performed ICSBEP and IRPhEP benchmark evaluation reviews in support of the publication of the 2019 edition of these handbooks.
9. CEdT process support as NDAG Chair and CEdT Team Member for:
    a. IER-184 (TEX Pu/Ta) CED-3b
    b. IER-299 (KRUSTY Cold/Warm Test) CED-3b
    c. IER-480 (TEX Poly & Lucite Moderated) CED-1
    d. IER-230 (7uPCX w/ Optimal Moderation) CED-2
    e. IER-451 (LEU-COMP-THERM-099) CED-4b
    f. IER-489 (Curie) CED-2
    g. IER-206 (BUCCX w/ Rh) CED-4b
    h. IER-297 (TEX HEU/Hf) CED-3a
    i. IER-441 (7uPCX w/ Ta) CED-2

$3k was expended in support of NDAG Chair activities during FY2019 Q2. FY2018 carryover was determined to be $8k and will be applied to FY2019 budget.

Summary of MCNP Criticality Classes in FY 2019

F.B. Brown, M.E. Rising, J.L. Alwin
Monte Carlo Methods, Codes, & Applications Group (XCP-3), LANL

FY2019 – Q2 classes are highlighted in red.

Classes sponsored by DOE-NNSA-NCSP (LANL-AM1, TE4)

- **Sensitivity-Uncertainty Tools & Practices for NCS Validation**
  - May 15 & 16, 2019, Hanford & PNNL 17 students, postponed from Feb 13 & 14

  This is a joint effort between LANL & ORNL, covering background material and specific usage of MCNP6-Whisper and SCALE-KENO-TSUNAMI-TSURFER. D. Bowen coordinates scheduling at DOE sites.

- **Criticality Calculations with MCNP6**
  - **Mar 18-22, 2019, LANL 7 students**
  - May 6-9, 2019, Sandia 17 students
  - August 19-23, 2019, Y-12 TBD
  - Aug 5-9, 2019, LANL scheduled

  MCNP criticality class for NCS & reactor physics practitioners, with focus on best practices. Includes 1 day on NCS validation using MCNP6-Whisper. For classes at LANL, NCSP-sponsored students do not pay registration fees. For classes at other DOE sites, there are no registration fees.

- **Monte Carlo Techniques for Nuclear Systems**
  - Aug 24 – Dec 7, 2019, UNM 20 students

  This is a 1-semester class for senior undergrads & graduate students at the University of New Mexico. Required for UNM graduation in Nuclear Engineering. Includes Monte Carlo theory & practical use of MCNP6. Several of the students are part of the LANL NCS intern program. (This teaching is partially supported by NCSP, ASC, and other programs.)

Other Classes (LANL-AM1)

- **Introduction to MCNP6**
  - Dec 3-7, 2018, LANL 15 students
  - **Mar 4-8, 2019, LANL 15 students**
  - Apr 1-5, 2019, OECD-NEA, Paris 7 students
  - June 3-7, 2019, LANL scheduled
  - June 17-21, 2018, LANL scheduled
  - July 29 – Aug 2, 2019, LANL scheduled
  - Oct 21-25, 2019, LANL scheduled

  Standard introductory class, includes 1/2 day on criticality calculations (without coverage of NCS validation using mcnp6-whisper). Classes at LANL are supported by student registration fees.

- **Intermediate MCNP6**
  - **Mar 11-15, 2019, LANL 15 students**
  - Apr 8-12, 2019, OECD-NEA, Paris 16 students
  - Oct 7-11, 2019, OECD-NEA, Paris scheduled
  - Oct 28 – Nov 1, 2019, LANL scheduled

2019 Q2 – SCALE Training Courses Report for the Nuclear Criticality Safety Program

Class Name	Source Terms and Radiation Shielding for Spent Fuel Transportation and Storage Applications Course
Class Dates	Jan 28 – Feb 1, 2019
Location	Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	9
Short Description	One of the unique features of the SCALE code system is the flexibility of assembling different SCALE codes or sequences to solve complex problems. Transportation and storage of spent fuel require a computational tool set to characterize both the spent fuel source terms and the doses for containers used to transport or store the fuel. Spent fuel is a complex neutron and photon source that can be well characterized using the ORIGEN code in SCALE. Additionally, ORIGEN can be used to characterize the radioactive sources resulting from activation of non-fissile materials and components in a nuclear reactor, such as the pressure vessel. The variety of source terms generated with ORIGEN can be used for shielding analyses with the MAVRIC sequence. MAVRIC can estimate particle fluxes and dose rates outside of containers, to ensure that the safety requirements for transportation, storage and ultimate disposal of spent fuel or activated materials are met. This one-week course will first cover the use of ORIGEN for isotopic depletion, decay and radiation source-terms calculation, generation of ORIGEN activation libraries, and the use of the ORIGAMI tool for quick calculation of spent fuel sources. The next part of the course will focus on MAVRIC, including: building complex 3D models (materials and compositions); using a connection to the ORIGEN libraries to model simple radioactive sources; importing complex ORIGEN sources; and, calculating neutron fluxes to create ORIGEN activation libraries. Additionally, the advanced variance reduction tools for deep penetration problems, CADIS and FW-CADIS, that are the foundation of MAVRIC will be covered. This class uses the Fulcrum user interface for interactive model setup, visualization, computation, and output review.

Class Name	SCALE Criticality Safety Calculations
Class Dates	Feb 18 – 22, 2019
Location	Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	18
Short Description	This course provides instruction on the use of the KENO Monte Carlo codes for criticality safety calculations and is appropriate for beginning through advanced users. KENO V.a is a fast and easy-to-use code that allows users to build complex geometry models using basic geometrical bodies such as cuboids, spheres, cylinders, hemispheres, and hemicylinders. KENO-VI is a 3-D generalized geometry Monte Carlo code that allows for versatile modeling of complex geometries. Both versions of KENO provide convenient, efficient methods for modeling repeated and nested geometry configurations such as lattices. Both versions of KENO use ENDF/B-VII.0 or ENDF/B-VII.1 cross-section data distributed with SCALE to perform either continuous energy (CE) or multigroup (MG) calculations. KENO includes a 2D color plotting capability and produces easy-to-navigate HTML output. This class uses the Fulcrum user interface for interactive model setup, visualization, computation, and output review. The KENO3D tool is still used in SCALE 6.2 for 3-D

	visualization. Instruction is also provided on the SCALE material input and resonance self-shielding capabilities and Fulcrum capabilities for visualizing fluxes, reaction rates, and cross-section data

Class Name	Nuclear Data Fundamentals and AMPX Libraries Generation Course
Class Dates	Feb 25 – March 1, 2019
Location	Oak Ridge National Lab, Oak Ridge, TN
Number of Attendees	7
Short Description	This course takes the participants through the fundamentals of the nuclear data pipeline, from the creation of Evaluated Nuclear Data File (ENDF) libraries, through processing with the AMPX code suite, to end use in SCALE. In addition to their use in SCALE, AMPX libraries are used in the CASL VERA high-fidelity multi-physics code suite; provide depletion, activation, and decay data for ORIGEN, which is integrated in a wide range of tools; and generate covariance data used in sensitivity uncertainty (S/U) calculations. This course is relevant for all users interested in understanding the sources, approximations and important differences in nuclear data libraries as well as for the advanced practitioners wishing to learn to process nuclear data libraries on their own. Those interested in generating custom libraries, whether from international sources such as the Joint European Fission Fusion (JEFF), the Japanese Evaluated Nuclear Data Library (JENDL), among others, or generating special purpose libraries with customized group structures and weighting spectra will find this course particularly useful. The course is focused on the practical use of the AMPX nuclear data processing code distributed with SCALE and includes demonstrations and in-class exercises, in addition to theoretical lectures. Participants will learn how nuclear data, along with associated uncertainty information, is generated before it enters the ENDF library. They will then be guided through the building of processed libraries for neutron transport in continuous-energy and multi-group formats. Nuclear data uncertainty information and its propagation to quantities of interest through S/U methods will be discussed and the associated AMPX processing capabilities will be demonstrated. Detailed discussion of nuclear data validation will be presented. The course will conclude with lectures on fission product yield and decay data and associated uncertainties, along with demonstrations of their use in SCALE.

Class Name	SCALE Criticality Safety and Radiation Shielding Course
Class Dates	March 4 – 8, 2019
Location	NEA Data Bank, Paris, France
Number of Attendees	17
Short Description	This course provides instruction on the use of the KENO-VI Monte Carlo code for criticality safety calculations and the MAVRIC (Monaco with Automated Variance Reduction using Importance Calculations) shielding sequence with 3-D automated variance reduction for deep-penetration problems. KENO-VI is a 3D eigenvalue Monte Carlo code for criticality safety and Monaco is a 3D fixed-source Monte Carlo code for shielding analysis. Both codes use the SCALE Standard Composition Library and the SCALE Generalized Geometry Package (SGGP), which allows for versatile modeling of complex geometries and provides convenient, efficient methods for modeling repeated and nested geometry configurations such as lattices. The MAVRIC sequence is based on the CADIS (Consistent Adjoint Driven

	Importance Sampling) methodology. For a given tally in a Monte Carlo calculation that the user wants to optimize, the CADIS method uses the result of an adjoint calculation from the Denovo 3D deterministic code to create both an importance map for weight windows and a biased source distribution. MAVRIC is completely automated in that from a single user input, it creates the cross sections (forward and adjoint), computes the adjoint fluxes, creates the importance map and biased source, and then executes Monaco. An extension to the CADIS method using both forward and adjoint discrete ordinates calculations (FW-CADIS) is included in MAVRIC so that multiple point tallies or mesh tallies over large areas can be optimized (calculated with roughly the same relative uncertainty). Both KENO and Monaco use ENDF/B-VII.0 or ENDF/B-VII.1 cross-section data distributed with SCALE to perform continuous energy (CE) or multigroup (MG) calculations. Both codes can also be used with the Fulcrum consolidated SCALE user interface and KENO3D for interactive model setup, computation, output review, and 3-D visualization. Instruction is also provided on the SCALE material input and resonance self-shielding capabilities and the data visualization capabilities within Fulcrum for visualizing fluxes, reaction rates, and cross-section data as well as mesh tallies. KENO-VI and MAVRIC can be applied together to perform an integrated criticality accident alarm system (CAAS) analysis.

Class Name	SCALE/ORIGEN Standalone Fuel Depletion, Activation, and Source Term Analysis Course
Class Dates	March 11 – 15, 2019
Location	NEA Data Bank, Paris, France
Number of Attendees	20
Short Description	This is a hands-on class that covers the use of ORIGEN for isotopic depletion, decay, decay heat, and radiation source-terms calculations. The course features the use of the Fulcrum consolidated SCALE graphical interface and its' plotting capabilities for displaying nuclear data and results. Participants will learn about ORIGEN's capabilities and nuclear data, how to generate ORIGEN libraries, and how to use ORIGEN for activation, spent fuel, and nuclear safeguards applications. This class introduces the ORIGAMI tool for convenient characterization of spent nuclear fuel with radially and axially varying burnup. Advanced applications including simulation of chemical processing, continuous feed and removal are also covered.

STATUS REPORT
on the
International Collaboration with the Institut de Radioprotection et de Sûreté Nucléaire (IRSN) for FY2019

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2019 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
Analytical Methods						
IRSN-AM15	MCNP Maintenance and Support / Uncertainty Analysis Development / Modernization / etc.	LANL-AM1	Interest for uncertainty analysis, source convergence development and modernization strategy	E. DUMONTEIL	F. BROWN	LANL
Q2: Theoretical modeling of variance to mean ratio and spatial correlation of critical and under-critical systems with intrinsic sources.						
IRSN-AM16	Multi-Physics Methods for Simulation of Criticality Excursions	LLNL-AM2	Technical exchanges on the proposed multiphysics tasks for simulating criticality excursions.	M. DULUC	D. HEINRICHS	LLNL
Task not started. To be deleted from the list of IRSN contributions.						
IRSN-AM1	Validation and qualification methods	ORNL-AM2 ORNL-IPD4	Covariance matrices establishment of the selection of Integral Experiments	I. DUHAMEL	D. BOWEN B. REARDEN	ORNL
This task was initiated in the frame of the OECD/NEA UACSA expert group. Experimental correlations were established for LCT007 and LCT039 – need to contact Brad Rearden to discuss about the experiments of interest for the FY2019.						
IRSN-AM3	Monte Carlo & sensitivity calculations	ORNL-AM2	Technical exchanges on sources convergence issues, sensitivity coefficients calculations and kinetics parameters calculations	B. DECHENAUX	D. BOWEN B. REARDEN	ORNL
IRSN-AM5	Update of the slide rule	ORNL-AM6 LLNL-AM3 AWE-AM1	Subtask 2 of IRSN proposal Update of the “slide rule” for the rapid response estimation of a criticality accident (using COG, MCNP, MAVRIC, ATTILA…)	M. DULUC	D. BOWEN D. HEINRICHS C. WILSON	ORNL LLNL AWE
Q2: Report published. The next step will be in particular the number of fissions estimate (meeting about this subject during the TPR meeting, Amarillo).						
IRSN-AM7	ACE QA testing and implementation	LANL-AM2	Implementation of the defined QA tests in ACEtk and integration in GAIA	L. LEAL	J. CONLIN	LANL
Report provided by LANL to IRSN by Wim Haeck with detailed descriptions.						
IRSN-AM8	Analytical Methods Working Group	NCSP-TS2	IRSN participation to NCSP analytical methods Working Group and IRSN participation to TPR meeting	S. EVO	F. BROWN D. BOWEN	NCSP
Q2: IRSN participation in AMWG and TPR meeting in March 2019 at Pantex Plant.						
IRSN-AM9	Cross sections processing validation	ORNL-AM3	Development of an interface between GAIA and AMPX and test interface capabilities. AMPX training desired by IRSN staff in FY2019.	R. ICHOU	D. WIARDA D. BOWEN	ORNL
Tool for generating AMPX multigroup cross section library with DRAGON. Task needs completion. Possibility of an AMPX training course in June or July						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2019 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
IRSN-AM13	Benchmark intercomparison study	LLNL-AM5 ORNL-AM10 LANL-AM5	Definition of common set of developed benchmark models Calculations for Pu and HEU systems. (Completion of this task before ORNL-AM9 and LANL-AM4 would be useful to identify common benchmarks.)	I. DUHAMEL	D. HEINRICHS D. BOWEN F. BROWN	LLNL ORNL LANL
IRSN-AM13 in progress –Results from different labs collected – preliminary analyses done → feedback on COG and MORET input decks – common paper for ICNC (abstract submitted) Q2 : preliminary analyses presented at TPR meeting in March 2019 – common paper planned for ICNC 2019						
IRSN-AM14	Sensitivity/Uncertainty comparison study with a focus on Upper Subcritical Limits	ORNL-AM9 LANL-AM4	Definition of three test cases Calculations and intercomparison technical report	I. DUHAMEL	F. BROWN D. BOWEN	LANL ORNL
In progress – LANL and ORNL results are available – first results with MACSENS are being analysed → some issues with MACSENS dev. Q2 : technical exchanges during AM meeting in March						
IRSN-AM17	Technical Data for the Pitzer Formulation of Solution Compositions to Include Uranium/Plutonium Solutions with Selected Admixed Absorbers	ORNL-AM16 LANL-AM6 LLNL-AM7	Contribution to measurements definition. Comparison of density laws (isopiestic law for instance)..	N. LECLAIRE	D. BOWEN	ORNL
Measurements should have been performed last autumn. IRSN contacted Jennifer Alwyn and the measurements were not performed due to budget issues. Pending resolution of these issues, the action could be performed in 2019-2020. Plutonium sulfate densities should be retrieved from US laboratories and a comparison could be done with plutonium nitrate densities. It is also planned to make density vs temperature measurements.						
Integral Experiments						
IRSN-IE1 **IER 184**	TEX - Ta experiment	LLNL-IE4	Sensitivity/uncertainty calculations Contribution to the evaluation of the first experiments.	M. BROVCHENKO	C. PERCHER	LLNL
IRSN is involved in TEX program since the beginning in 2011 and participated in the kick-off meeting. IRSN is part of the CED team and review the CED reports. In addition, in 2014 and 2015, IRSN performed sensitivities calculations on the designed configurations for TEX-Ta experiments. Regular VTC were organized to discuss the status of experiments. IRSN participated at the 2 last experiments in NNSS and will be involved in the ICSBEP evaluation in 2019 as independent reviewer.						
IRSN-IE3 **IER 209**	New 7uPCX experiment	SNL-IE1	Contribution to ICSBEP reevaluation.	N. LECLAIRE	G. HARMS	SNL
These experiments were finally not presented at the October 2018 meeting						
IRSN-IE6 **IER 306**	Rh foils experiment	SNL-IE1	IRSN proposal: preliminary evaluation of experimental uncertainties prior to the experiment's CED-2 report.	N. LECLAIRE	G. HARMS	SNL
CED 1 report has been sent to the NCSP team review and is also in the IRSN validation process and will be issued in June/July 2019. Preliminary effects on keff of experimental uncertainties have been calculated and will be added in the CED-2 report in 2019. (supported by a sub-contract)						
IRSN-IE7 **IER 305**	Mo foils and rods experiment	SNL-IE1	IRSN proposal: Leading the CED-3a report; Supplying the Mo rods for the experiment.	N. LECLAIRE	G. HARMS	SNL
The CED-2 report has been postponed. As a consequence, this task should not be totally done in 2019. We looked at potential suppliers for the Mo sleeves and estimated the costs. However, we waited for the CED-2 report to be finished before proceeding to the supplying of sleeves.						
IRSN-IE8 **IER 451**	Ti experiment	SNL-IE1	Analysis of the experiments Comparison with MIRTE program	N. LECLAIRE	G. HARMS	SNL

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2019 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
The independent review of experiments was done for the ICSBEP October 2018 meeting. The experiments were calculated with MORET 5. Some comparisons of sensitivity profiles are expected with the sensitivity obtained with TSUNAMI. In addition, we also plan to compare them with the sensitivities obtained for the MIRTE experiments. These tasks are subject to a subcontract beginning in May 2019.						
IRSN-IE11 **IER 297**	TEX - Hf experiment	LLNL-IE4	Contribution to Jemima plates characterization. Contribution to CED report.	M. BROVCHENKO	C. PERCHER	LLNL
IRSN was involved in the review of the CED2 report and provide some sensitivity calculations to LLNL. The status of the program has been discussed regularly during VTC until 2017 with LLNL. On stand-by, waiting from LLNL						
IRSN-IE15 **IER 253**	International intercomparison exercise using FLATTOP	LLNL-IE1 AWE-IE3	Participation in the design, contribution to the experiments with IRSN materials, and the report.	M. DULUC F. TROMPIER	D. HEINRICHS C. WILSON	LLNL AWE
Exercise done in May 2018. Report in progress.						
IRSN-IE19	Solution reactor	Y12-IE2	Strong IRSN interest for participation in the design, specification… of a solution reactor	M. DULUC	P. ANGELO	Y-12
Task started. A first contact with Peter Angelo.						
IRSN-IE25 **IER 296**	TEX - MOX experiment	LLNL-IE4	IRSN leads this proposal for design and will author the CED-1 & 2 reports with LLNL support. Characterization of moderator and reflector plates. IRSN contribution to the moderator and reflector plates funding.	M. BROVCHENKO	C. PERCHER	LLNL
Design optimization for TEX-MOX ongoing. (Supported by sub-contracts in 2018 and 2019)						
IRSN-IE26 **IER 295**	TEX - Iron experiment	LLNL-IE4	Contribution to the experiments design. Contribution to CED reports and review.	M. BROVCHENKO	C. PERCHER	LLNL
This task is on stand-by for NCSP						
IRSN-IE27 **IER 175**	GODIVA CAAS benchmark	ORNL-IE4	Participation in the design. Provide IRSN materials for irradiation, analysis of results.	M. DULUC	T. MILLER	ORNL
Task not started.						
IRSN-IE28 **IER 406**	Cf-252 CAAS benchmark	LLNL-IE1	Participation in the design. Provide IRSN materials for irradiation, analysis of results	M. DULUC F. TROMPIER	D. HEINRICHS	LLNL
Discussion in progress to perform additional measurement in 2019.						
IRSN-IE29	Correction factor for dosimetry linked to the orientation of the victim	LLNL-IE1 AWE-IE7	Participation in the design. Provide IRSN materials for irradiation, analysis of results.	M. DULUC F. TROMPIER	D. HEINRICHS C. WILSON	LLNL AWE
Task not started						
IRSN-IE30	Full dosimetry exercise around GODIVA/FLATTOP reactors	LLNL-IE1	Participation in the design. Provide IRSN materials for irradiation, analysis of results	M. DULUC F. TROMPIER	D. HEINRICHS	LLNL
Task not started						
IRSN-IE33	Sodium activation experiment around GODIVA/FLATTOP	LLNL-IE1	Participation in the design. Provide IRSN materials for irradiation, analysis of results	M. DULUC F. TROMPIER	D. HEINRICHS	LLNL
Task not started						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2019 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
IRSN-IE34	HEU critical and Subcritical measurements	LANL-IE23	Participation in the definition and the design of the experiment	W. MONANGE	J. HUTCHINSON	LANL
Task started						
IRSN-IE35 **IER 434**	Godiva benchmark for time dependent code validation	LANL-IE3	Participation in the preliminary design and CED-1 report.	M. DULUC	J. GODA	LANL
Task not started						
IRSN-IE36	ICSBEP Shielding benchmarks for shipping containers	LLNL-IE13 AWE-IE8	Participation in the preliminary design and CED-1 report	M. DULUC	D. HEINRICHS C. WILSON	LLNL AWE
Task not started						
IRSN-IE37	Critical and subcritical measurements with a Zero-Power research reactor (On going task)	LANL-IE21	Analysis of the experiments, participation in the final technical report.	E. DUMONTEIL	J. HUTCHINSON	LANL
Q2: End of Nick Thompson postdoc at IRSN. The work on error bars estimation on power and positions has mostly been achieved. Simulations with intrinsic sources are on-going.						
IRSN-IE39	Thermal/Epithermal Experiments (TEX) Plutonium Experiments at Low Temperatures	LLNL-IE19	Participation in experiments design and CED reports. To be discussed with LLNL.	M. BROVCHENKO	D. HEINRICHS	LLNL
Task not started.						
IRSN-IE40	CAAS performance testing	LLNL-IE21	Participation in testing activities. Provide IRSN materials and French CAAS probes. To be discussed with LLNL.	M. DULUC	D. HEINRICHS	LLNL
Task not started						
IRSN-IE41	Thermal/Epithermal Experiments (TEX) with Chlorine and Lithium	LLNL-IE23	Participation in experiments design and CED reports. To be discussed with LLNL.	M. BROVCHENKO	D. HEINRICHS	LLNL
Task not started.						
Information Preservation and Dissemination						
IRSN-IPD1	ICSBEP reviewing	LLNL-IPD1	IRSN ICSBEP reviewing tasks are reported in the IE tasks	I. DUHAMEL	D. HEINRICHS	LLNL
ICSBEP reviews of SCRAP, ISSA and titanium experiments in October 2018 – Review of TEX-Ta planned for the Q4 of FY 2019						
IRSN-IPD3	ICSBEP benchmark reviewing	LLNL-IPD1	IRSN ICSBEP reviewing tasks	I. DUHAMEL	J. FAVORITE	LANL
Not started – waiting for FLATTOP re-evaluation						
Nuclear Data						

	REFERENCE		IRSN Contribution / POC			
IRSN Reference	**Task Title**	**DOE Reference**	**FY 2019 IRSN Contribution**	**IRSN Technical POC**	**DOE Technical POC**	**DOE LAB**
IRSN-ND1	Contribution to new evaluations	ORNL-ND1	Contribution to new evaluation and validation for ^{54}Fe, ^{103}Rh, ^{55}Mn and Gd isotopes	L. LEAL	D. BOWEN	ORNL
^{103}Rh resolved evaluation completed. Progress on the ^{54}Fe and ^{56}Fe and preliminary resonance evaluation generated. IRSN benchmark assembled for testing the ^{55}Mn evaluation. New capture data from NTOF included in the Gd-155 and Gd-157 evaluation. Improved Gd resonance parameters available. Q2: Paper on Gd for ND2019 conference. Generation of covariance data for ^{155,157}Gd						
IRSN-ND2	Nuclear data processing	LANL-ND1	Benchmark testing of ^{235}U and ^{239}Pu cross section library	L. LEAL	J. CONLIN	LANL
Test performed and new ^{235}U and ^{239}Pu resonance parameters generated.						
IRSN-ND3	Nuclear data processing	LLNL-ND4	Resonance evaluation of ^{233}U (Pending prioritization of ^{233}U ND tasks for the NCSP)	L. LEAL	D. HEINRICHS	LLNL
Existing resonance evaluation extended to 2 keV. New resonance parameters derived.						
Training and Education						
IRSN-TE1	Hands-on criticality safety training	ORNL-TE1 LANL-TE3 LLNL-TE1 SNL-TE1	IRSN attendance to NCSP classes. Possible lectures by IRSN working with NCSP training and education coordinator.	S. EVO	D. BOWEN	NCSP
2 IRSN staff attending the hands-on training in January 2019.						